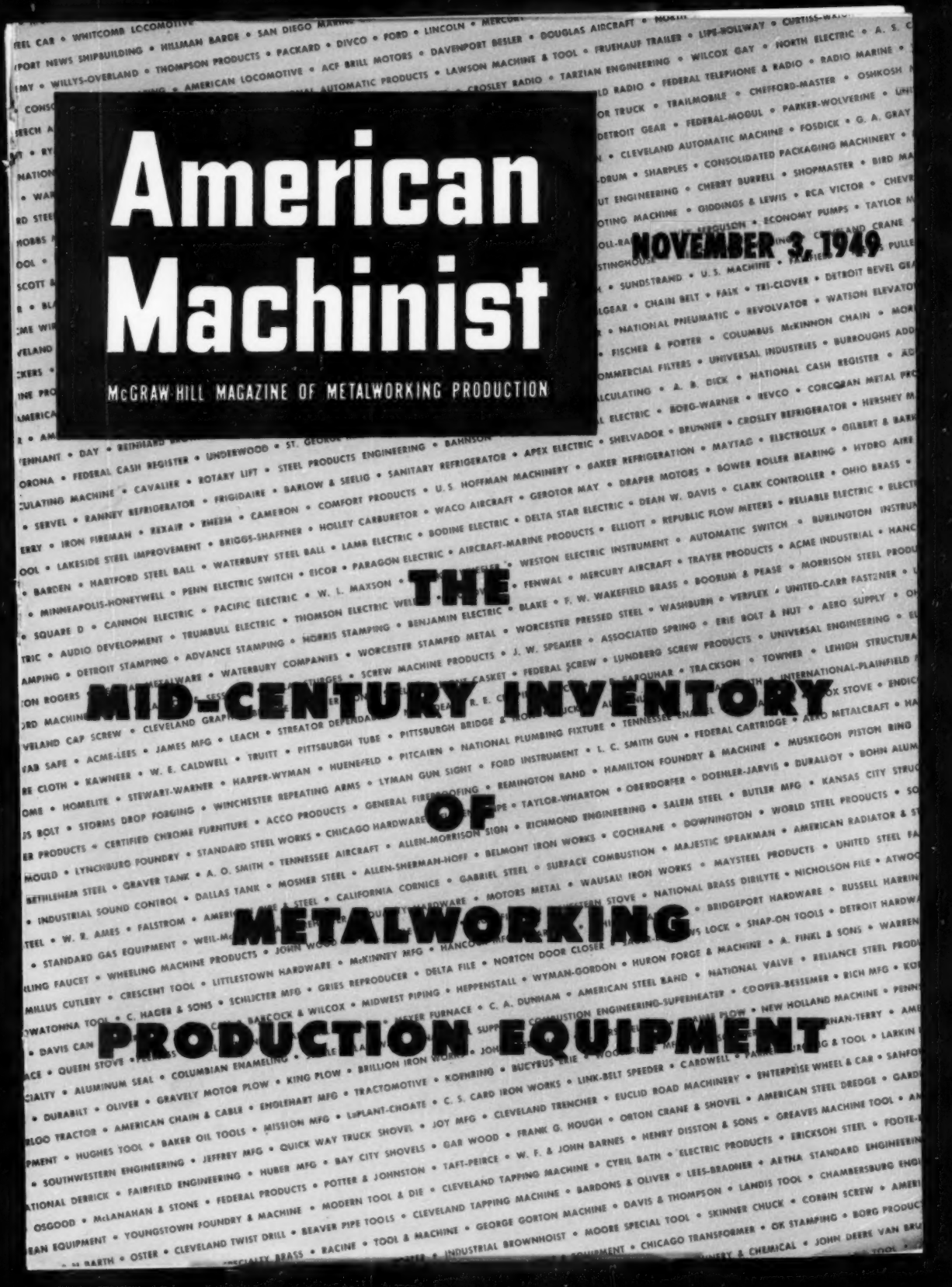
American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
NOVEMBER 3, 1949
THE
MID-CENTURY INVENTORY
OF
METALWORKING
PRODUCTION EQUIPMENT

What is the

RETIREMENT AGE

of a Machine Tool?

The real answer depends, not on the old machine...but on THE NEW ONE!

A machine that you purchased 5, 10, or even 15 years ago may still be in excellent condition today—still able to do its job just about as well as the day it was installed. Then why consider retiring it?

For the answer, look at the new machine that should replace it. Will the new one do the job faster—better—at lower cost per part? Retirement is then a matter of simple arithmetic. The new line of Heald machines, for example, incorporates so many new ideas and design improvements that, by comparison, most older machines are no longer economical to operate. And when a machine starts costing you money—that's the time for retirement!

If you're in doubt about the retirement age of any of your precision finishing machines, why not ask the advice of your nearest Heald representative? He will be glad to help you.

HEALD

PRECISION INTERNAL AND SURFACE GRINDERS

PRECISION BORE-MATIC FINISHING MACHINES

THE HEALD MACHINE COMPANY
Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit
Indianapolis • Lansing • New York

HERE'S A TYPICAL EXAMPLE:

This New Heald Model 171 Chuck-Type Internal is now doing a job where the production time for rough and finish grinding of steel sleeves has been reduced from 405 seconds to 165 seconds—a saving of 239 seconds per part. What's more, the new machine gives even better finish, better size, better accuracy than the equipment which it replaced. And it's much easier to operate, with high-speed automatic cycle and hi-frequency wheelhead. This new machine has proved a highly profitable investment—one that could not have been postponed longer without serious loss to the user.

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Our Cover . . . How does one illustrate an inventory? We tried a number of potential ideas, finally discarded all in favor of a radically different cover, one that indicates, in a small way, the tremendous amount of work put into the taking of this inventory by companies all over the United States. Companies large and small prepared figures for us in the realization that the ultimate statistics help everyone in the industry. To them, your thanks and ours are due for a Mid-Century Inventory that incorporates data from twice as many companies as ever took part in it before. Their cooperation has made it possible to present far more detailed information than we have previously attempted.

Canned Bier . . . From Germany comes a letter suggesting that, to overcome the shortage and high cost of wood, burial caskets be made from sheet steel of the same gage as used in the canning industry. (Page Mr. Hormel.) Realizing that a 6-ft can would be likely to sag appreciably when loaded, the good doctor suggests that this could be avoided by using a framework of standard pipe or of rods made by rolling up thin steel sheet. The carrying handles would be attached to the frame, and the cover also attached to it by screws.

Carrying the thought still further, he suggests that the conventional form of coffin be abandoned in favor of a tubular type of either round or square cross-section with a lid at one end. Of welded construction, it would be much stronger than the folded box type and would need no reinforcing frame. It could, of course, be suitably ornamented.

If made slightly tapered, the empty boxes could be stacked inside one another to save shipping and storage space, and could, if desired, be made with a sort of tongue at one end, to be folded upward when in use, to support the shoulders of the departed. The upper portion would be cut away to expose the features, and a suitably shaped end cover would form a permanent closure . . . Anyone care to buck public opinion and barbaric custom?

Ethics . . . The old definition of ethics was "whether or not you tell your partner." Now comes a different one: A partner, chided on his business practices, was asked, "What's become of your ethics?" He replied, "Traded it long ago for a Hudson." . . . We apologize, but thought you'd like to know.

The Inventory . . . For several months, a staff of statisticians has been hard at work, tabulating, analyzing and summarizing the returns in this greatest of our Inventories to date. They've worked under close direction of Associate Editor Ashburn, with the assistance of the other editors of *American Machinist* and of various specialized departments. We've changed the form of the Inventory to conform with Government classifications and to provide statistics by marketing areas rather than simply by geographic regions. We've shown total units, units 10 to 20 years old, and units over 20 years old, so it is a simple matter to determine ratios of new vs. old equipment in any sub-industry or area. We've added in surveys of maintenance and of college equipment—the first time such statistics have been attempted. And we've put it all together in a more compact, better classified form for your convenience.

How to Use It . . . With these figures, it is a simple matter to compare your plant with the averages in your industry or your area, or to check details of a type of equipment in both ways. Here is the evidence you need to present your equipment problems to top management or to back up your requests for modernization.

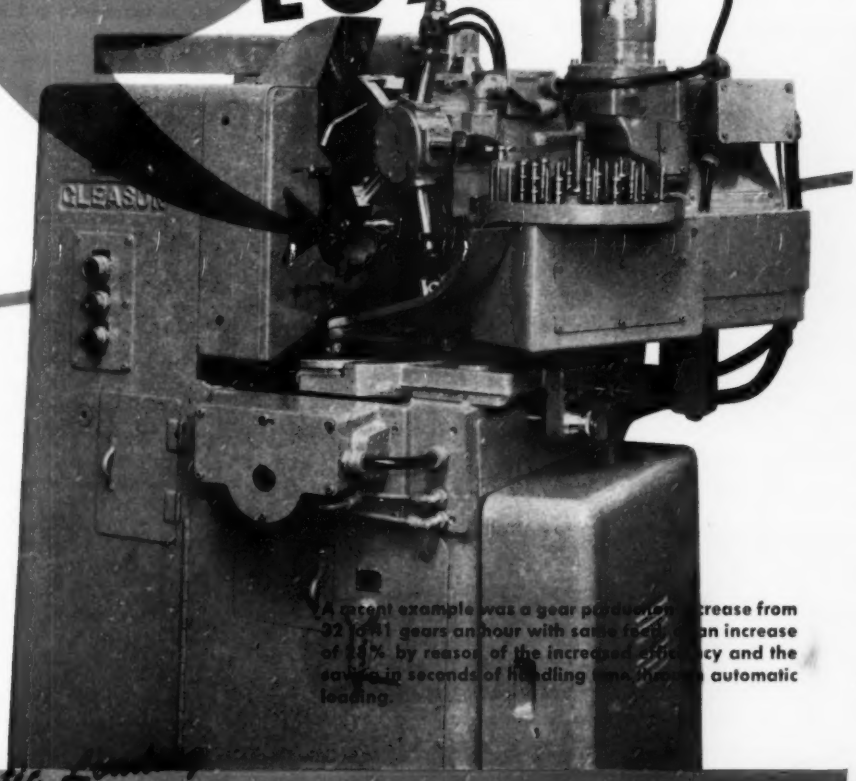
Points to Consider . . . Remember that any Inventory must have some arbitrary basis. We've chosen age, but particularly because of World War II, this cannot be the sole criterion. Many units considered "new"—because they were bought in the last ten years—are really superannuated veterans, when their 2- and 3-shift operation (frequently by "operators" trained overnight) and overloading are considered. Further, most of the units built before 1946 were built to war-frozen designs, some dating back to 1928. So there are at this particular time two additional criteria—present accuracy and modern design. Don't neglect them and their potentialialities in reducing scrap and production costs. These criteria are harder to evaluate and they don't lend themselves to statistical analysis—you'll have to check your own equipment, unit by unit. But equipment makers can give you comparable cases and figures to support your proposals for cutting costs—today's most important job.

Coming . . . Nov. 17 *A.M.* will be a compound of the unusual and the practical. Our cover, for example, will show the new Columbia University cyclotron being assembled, while a spread of pictures inside shows steps in machining parts for the 2,500-ton machine . . . Our Special Report will be a detailed study of the construction of modern mechanical presses, by Sergius D. Brootzkoos. It includes a table showing available types by make . . . Articles include one on secondary operations on screw-machine parts at Buick, another on overcoming the problem of fires in screw machines. There are also articles on spring stripper plates for dies, on indicating gages, on lapping curved surfaces, on slotting motor frames, and other features.

COUNT THE INCREASED OUTPUT THROUGH SECONDS SAVED

with

AUTOMATIC LOADING



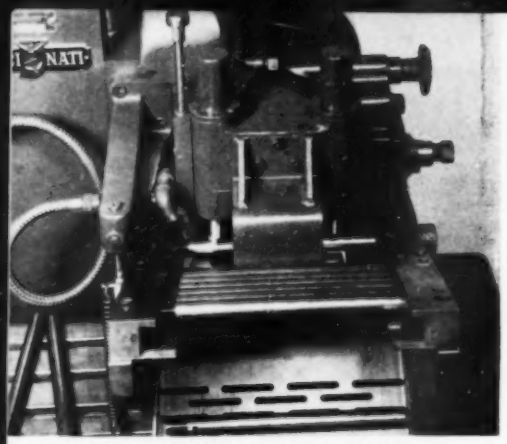
A recent example was a gear production increase from 32 to 41 gears an hour with same feed ... an increase of 28% by reason of the increased efficiency and the saving in seconds of handling time ... automatic loading.

Automatic Loading

provides steady continuous production without needless "down time" for the machine . . . furnishes uninterrupted operation at peak efficiency with close control of actual cutting . . . produces high quality spiral bevel, Zerol bevel and hypoid gears. And . . . The machine can be used for short run work when the loader is not required.

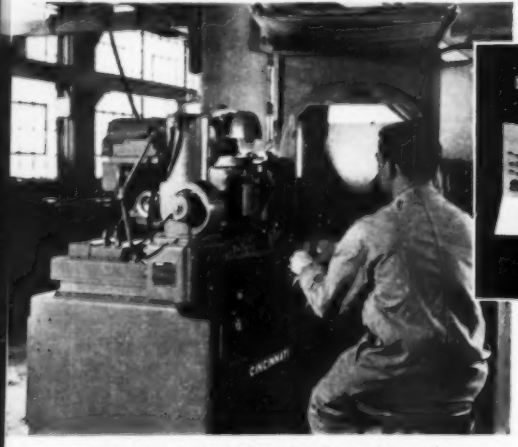
GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U. S. A.

Builders of Bevel Gear Machinery for Over Eighty Years



COMPLETELY AUTOMATIC—Milling Woodruff keyseats in generator shafts, on a new CINCINNATI No. 0-8 Automatic Rise and Fall Miller, at a production rate of 250 per hour.

DOWN-MILLING AND RAPID STOCK REMOVAL—Milling the top surface and slot (from the solid) of two cutter grinder tables at one time, removing 3/16" stock. Production nearly double with new CINCINNATI No. 5 Dual Power Dial Type.



UP TO FOUR TIMES FASTER—Grinding and inspecting simultaneously. Accurate form tool and die parts ground 30% to four times faster on new CINCINNATI Projecto-Form Grinding Machine.

We'd Like to Talk about

Man's ability to earn a living, and industry's to cut costs and earn a profit, depend largely upon machine tools. Not obsolete machine tools fifteen, twenty or thirty years old, but always the **newest** machine tools that do more and better work with less physical effort. Compared to the newest designs, the earning potential of machine tools only a few years old has gone downhill sharply. Consider these examples as proof of the cost cutting potential of new machine tools:

A new CINCINNATI FILMATIC Micro-Centric Grinding Machine outproduces two prewar machines; cuts grinding costs 75%, and at the same time improves quality of sizing, roundness and squareness with one end. New machine investment only 58% of previous equipment for comparable production.

Five diameters of a food mixer shaft motor are ground at the same time, on a CINCINNATI FILMATIC No. 2 Centerless Grinder. The machine is equipped with an automatic hydraulic infeed attachment and automatic magazine feed. Compared to the previous method of grinding these shafts on a center type machine, the cost has been reduced from five cents to one cent per shaft, saving about $9000 per machine in six months' time.

A new Tracer Controlled CINCINNATI Hydromatic Milling Machine, tooled up to mill various sizes of turbine blades, reduced the time per blade from 480 minutes to 25 minutes.

Glass molds, machined complete on a CINCINNATI 8" x 18" Tool and Die Miller, now re-

THE CINCINNATI

CINCINNATI

CINCINNATI 9,

to You Cutting Costs

quire only a fraction of the hand finishing formerly required. Additional savings are realized in the copy milling operation: now 18 hours compared to the former method which required 28 hours.

A progressive manufacturer of motors broaches the feet of motor frames on a CINCINNATI No. 5-54 Single Ram Vertical Hydro-Broach. One fixture accommodates four sizes of frames: cost reduced 40% over previous method.

Small sizes of CINCINNATI knee-type milling machines—Nos. 2ML and 2MI—are capable of taking up to 25% heavier cuts than their predecessors: handling and set-up time is 15 to 25% faster. In the largest sizes—Nos. 5 and 6 Dual Power Dial Type—cutting capacity has been increased 50 to 75%: handling and set-up time cut 35 to 40%.

Case histories like those cited here are commonplace for machine tools bearing the Cincinnati Milling or Cincinnati Filmatic trade-marks. A few more are illustrated at the left and right.

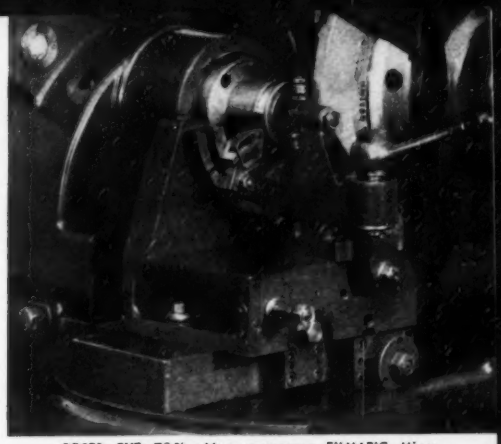
Why not bring your machining problems to us? Our nearest sales representative or direct field engineer will gladly help you. Better still, come with them to Cincinnati for a real cost cutting conference. We can help you cut your costs.

In all, there are 34 standard design types of Cincinnati Milling, Grinding and related machine tools, built in over 300 sizes and styles. CINCINNATI *FILMATIC Grinders handle work ranging from .004" diameter up to solid steel rolls 60" diameter, 15,000 times as large, and 665,000,000 times as heavy. Cincinnati Milling Machines mill parts ranging in size from ¼" to 47' long. There's a Cincinnati for your type of work in the fields of: MILLING • BROACHING • CUTTER SHARPENING DIESINKING • GRINDING • CENTERLESS LAPPING Write for a copy of our general catalog, publication No M-1646.*

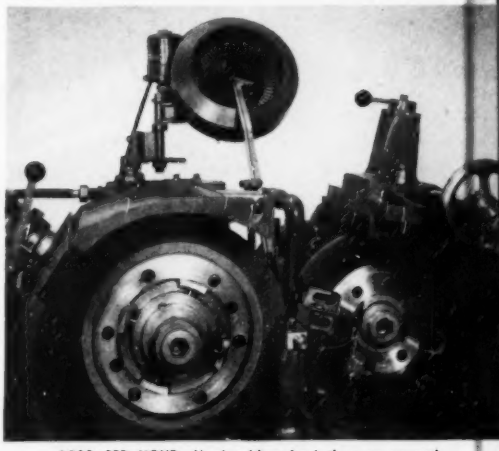
MILLING MACHINE CO.

GRINDERS INCORPORATED

OHIO, U. S. A.



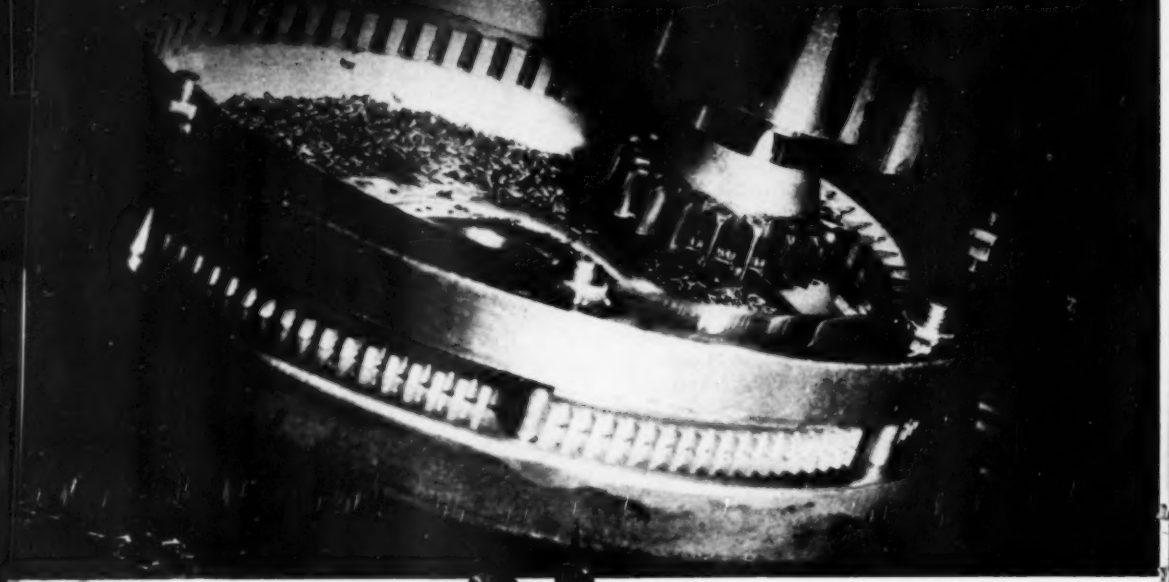
COSTS CUT 75%—New CINCINNATI FILMATIC Micro-Centric Grinding Machine, grinding bearing races at the rate of 125 per hour, outperforms two prewar machines in both quality and production.



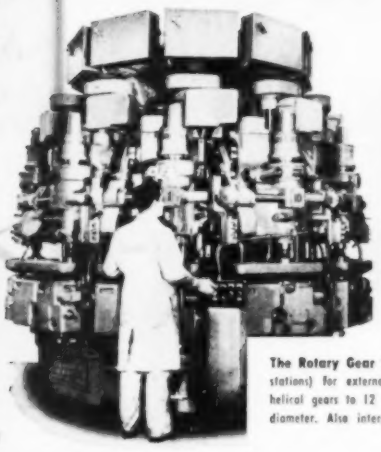
1200 PER HOUR—Hard rubber feed tips are ground at the rate of 1200 per hour on a new CINCINNATI FILMATIC No. 2 Centerless Grinder employing a new principle of infeed grinding—cammed regulating wheel.

MAINTENANCE CHARGES DECLINE SHARPLY—This new CINCINNATI FILMATIC 24" x 96" Roll Grinding Machine will require little maintenance in the years to come. Filmatic bearings, automatic way lubrication and electronic table traverse control assure dependability.

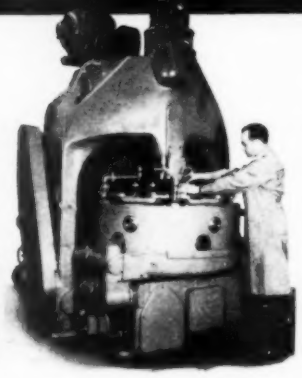
GOOD GEARS



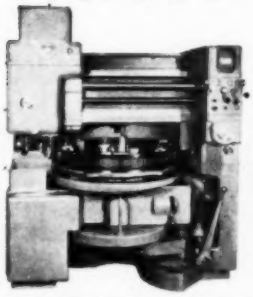
FELLOWS GEAR-



The Rotary Gear Shaper (10 stations) for external spur and helical gears to 12 inches pitch diameter. Also internals.



The Planetary Gear Shaper (6 work-spindles) for external spur and helical gears and pinions to 3½ inches pitch diameter.



The 36-inch Heavy-Duty Gear Shaper for intermediate and large size gears, and face widths up to 6 inches.

The 3-inch Fine Pitch Gear Shaper for small external and internal spur and helical gears. Often with magazine feed.

THE FELLOWS GEAR SHAPER COMPANY, Head Office & Export Dept., Springfield, Vermont.
Branch Offices: 616 Fisher Bldg., Detroit 2, Mich. • 640 West
Town Office Bldg., Chicago 12, Ill. • 7706 Empire State Bldg., New York 1, N. Y.

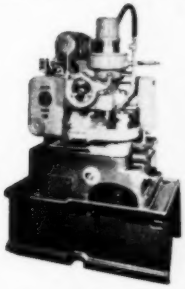
. . . . cheaper to produce

with FELLOWS' LATEST

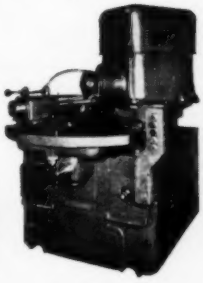
The late-model Fellows Machines offer the gear shop a major production advantage over older-type tooling. Increased stock-removal-capacity is offered in the large, medium and small machines, alike. Finer finish is achieved through still greater rigidity of work and tool relationship. Operating attendance costs come down with the rising importance of multiple-spindle machines.

Coordinated gear production operations may involve any combination of the machines and instruments shown below. Literature is available on all types. An inquiry addressed to the office nearest you will bring up-to-the-minute information of any kind, either general or specific.

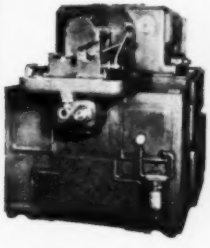
CUTTING ★ SHAVING ★ INSPECTION



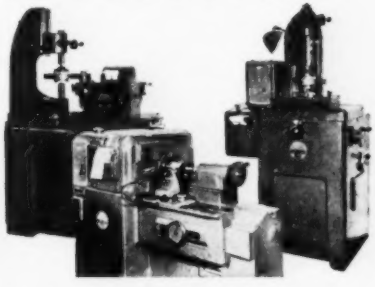
The 7-Type Gear Shapers for general service on external and internal spur and helical gears up to 7 inches.



The Full-Tool Shaving Machine for finishing external spur and helical gears up to 8 inches pitch diameter.



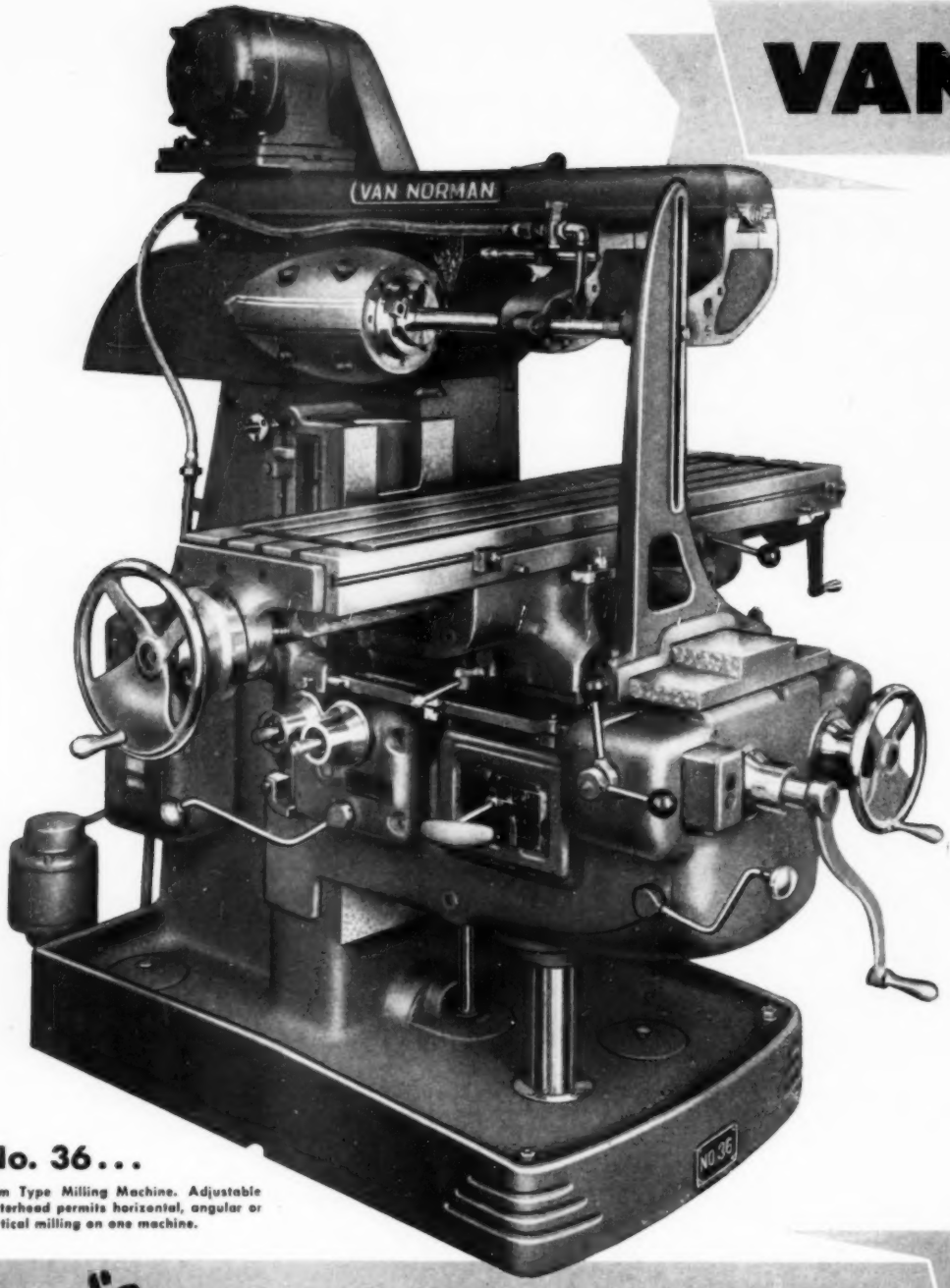
The No. 11 Gear Shaving Machine for finishing internal gears, both spur and helical, capacity dependent upon tool and fixtures.



The Inspection Instruments for (a) Involute measuring of tooth profiles (b) Lead measuring for the checking of lead, crown, and taper (c) "Red Liner" for inspection of errors in combination. All instruments are provided with automatic recording devices.

Fellows

VAN



No. 36...

Ram Type Milling Machine. Adjustable cutterhead permits horizontal, angular or vertical milling on one machine.

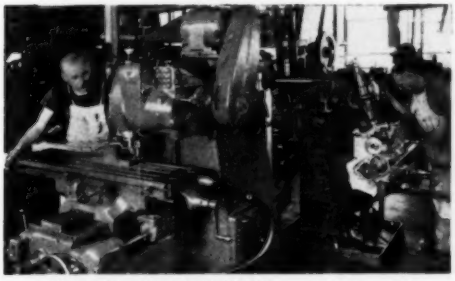
"It pays to Van Normanize"

NORMAN MILLERS

Speed Production in All Types of Plants

JOB SHOP — Van Norman Ram Type Millers perform all types of milling from horizontal to vertical by simply positioning the adjustable cutterhead.

PRODUCTION — Long runs or short runs, Van Norman Millers maintain production and quality on all types of work.



PATTERN AND DIE SHOP — The adjustable cutterhead on ram type millers permits a wide variety of work to be performed as encountered in this type of work.

TOOLROOM — Van Norman Horizontal and Ram Type Millers meet the requirements of accurate milling required in toolroom operations.

Here's How You Can Cut Costs and Increase Production

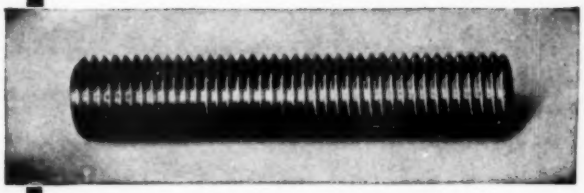
Regardless of the type of plant or type of work, Van Norman Millers . . . ram type and horizontal knee type . . . can cut your milling costs and speed production. These millers enable operators to perform more work because they are easy to operate. All operating controls are located at the front and rear of the machine saving operator steps, giving full cutting view to the operator. The extra heavy column, base and knee assemblies assure maximum rigidity . . . increase the accuracy of the machine. Large easy-to-read dials facilitate work adjustments. Quick change speed and feed selectors permit easy selection of the right feed and speed for every cut. Write for catalog describing the complete line of Van Norman Millers.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

CENTERLESS THREAD
by the *"THRU-FEED"*

210 STUDS PER HOUR

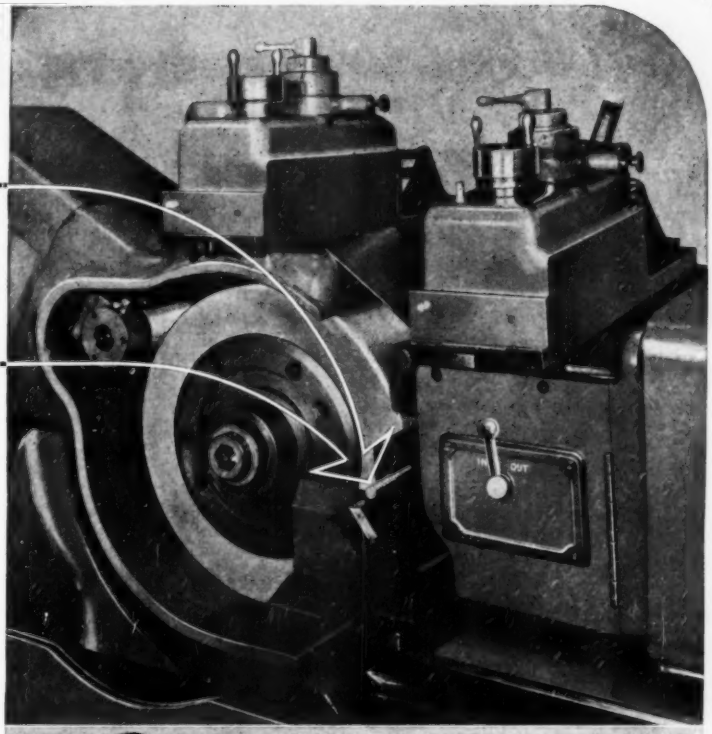


LANDIS NO. 1 CENTERLESS THREAD GRINDING MACHINE

LANDIS Machine COMPANY
WAYNESBORO · PENNA · U.S.A.

GROUND METHOD

Name of Part	Stud
Thread Specifications:	
Diameter	¾"
Pitch	10 USF
Thread Length	4"
Thread Tolerance	Class 7
Production Per Hour	210



The LANDIS No. 1 Centerless Thread Grinder is designed to grind screw threads on straight cylindrical workpieces and headed or multiple diameter parts.

Workpieces without interfering shoulders requiring threads on the maximum diameter only — headless set screws, continuously threaded studs, etc.—pass through the machine in a continuous flow (as illustrated) with no time lost for loading or unloading. The "thrufeed" method will grind $\frac{1}{8}$" to 4¾" diameter threads to unlimited lengths.

Headed or shouldered workpieces—cap screws, stripper bolts, etc.—are placed between the wheels one at a time and ejected automatically. The thread is ground in about 1½ revolutions of the part and close-to-shoulder threads are permitted. The "infeed" method will grind $\frac{1}{8}$" to 4¾" threads up to 7¾" in length.

Either process will grind threads from the solid or finish grind precut threads. Most types of thread forms can be ground to any required class of fit and for right or left hand threads.

Write for Bulletin E-97

LANDIS TRADE MARK REG. U.S. PAT. OFF.

$ $ $ Saving Reasons For Replacing Obsolete Cylindrical Grinders

LANDIS TOOL

Engineering Advances

Microsphere Wheel Spindle Bearings
Large Diameter Grinding Wheels
Formed Wheel Grinding
Adjustable Hydraulic Feeds and Work Table Traverse
Hydraulic Rapid Infeed
Variable Speed Headstocks
Multiple Wheel Grinding
Automatic Operating Cycles
Hydraulic Clamping of Work Pieces
Landis Tool Solex Automatic Sizing
Crush Form Wheel Dressing
Centerless Thread Grinding
Complete Vee Belt Drives
Eye Level Wheel Feed

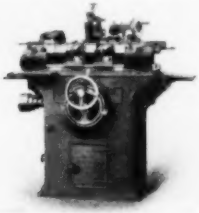
LANDIS TOOL
Precision Grinders

We will be pleased to talk to you about your precision grinding operations. Perhaps production advances such as these can be made in your own shop.

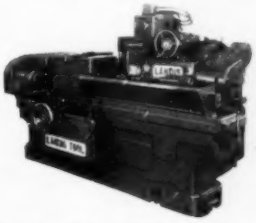
Examples of production increases made by modern Landis Tool Grinders and grinding methods which produced sensational savings and a high return on new equipment investment.

Cam contour grinding

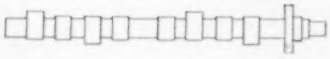
10 to 1 production increase



Old design 10"x 30" Landis Tool Cam Contour Grinder



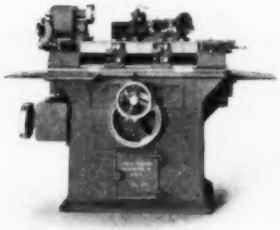
Modern Landis Tool 5"x 40" Type DH Hydraulic Cam Contour Grinder



Former production was 25 minutes per shaft to rough and finish grind 8 cam contours. Stock removal .030" to .0005" size variation. Same job on modern Landis Tool grinder done at rate of 24 shafts per hour. Due to semi-automatic operation, one man can operate two machines—one on roughing, the other on finish grinding.

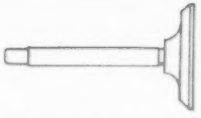
Valve stem grinding

4 to 1 production increase



Old design 10"x 20" Landis Tool Plain Grinder

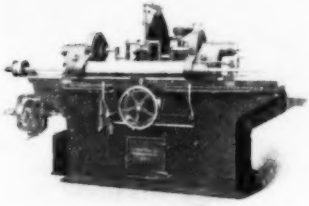
Modern Landis Tool #12 Centerless Grinder



On the old design plain grinder, the valve stem was finish ground to within .00025" size variation at the rate of 60 per hour. Stock removal .015". Today this same operation would be done on a Landis Tool #12 Centerless Grinder by the infeed grinding method. Three steps would be required: rough grinding, semi-finish grinding and finish grinding, all at the rate of 750 valves per hour, or an average output of 250 complete valves per hour per machine.

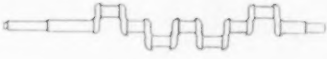
Crankshaft grinding

10 to 1 production increase



Old design 16"x 36" Landis Tool Crank Grinder

Modern Landis Tool 16"x 40" Crank Pin Grinder

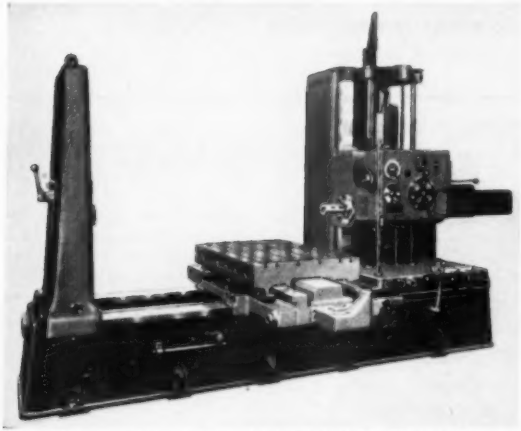


To grind the pins and line bearings of this crankshaft formerly required 1¾ hours per shaft. Stock removal .030", limits .0005". A modern Landis Tool crank pin grinder can do all four pins at the rate of 10 shafts per hour. Line bearings semi-finished and finished on 2 Landis Tool 16"x 40" multiple wheel grinders at a rate of 30 shafts per hour each. Total grinding time per shaft, 10 minutes.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

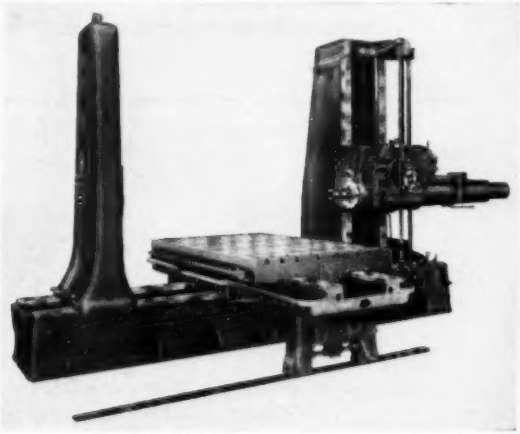
MORE PRODUCTION AND PROFIT

Multiple Purpose Horizontal Boring, Drilling and Milling Machines Profitably Perform a Broad Range of Machining Operations on an Endless Variety of Jobs.



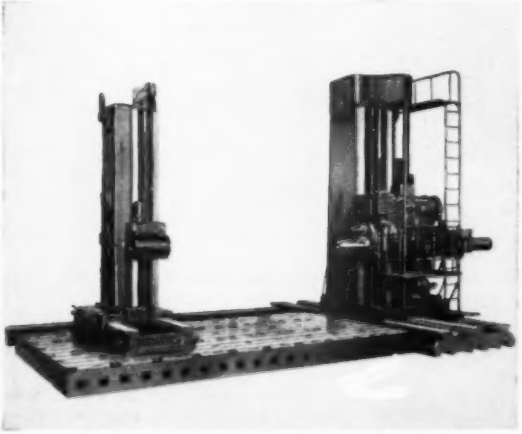
The versatile, medium size 300-B Table Type Horizontal Boring, Drilling and Milling Machine offers unusual advantages in machining operations. It provides unexcelled accuracy at high speeds on work sizes up to a 30" cube.

BULLETIN NO. 250-300-49



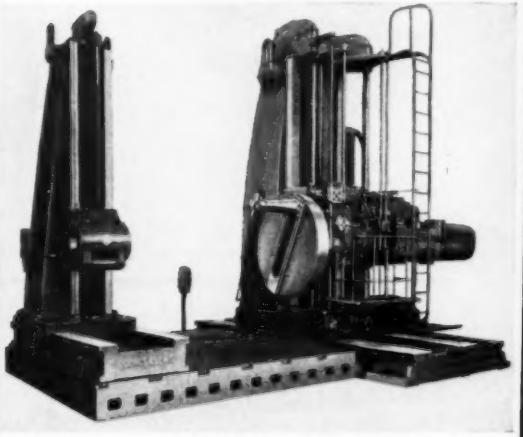
Increased work handling capacity is available with this 350-Table Type Machine. Extended saddle, saddle supports and auxiliary runways insure precision boring, drilling and milling operations on large jobs.

BULLETIN NO. 30T49



Extensive machining capacity for unusual work is a characteristic of the improved G. & L. 570-Floor Type Machine. It handles extra heavy, unwieldy work and simplifies machining hard-to-reach surfaces.

BULLETIN NO. 50F49



Basic design of all G. & L. machines provides for maximum flexibility. A continuous feed facing head enables this 780-Floor type Machine to do multiple operations in a single,setting of the workpiece.

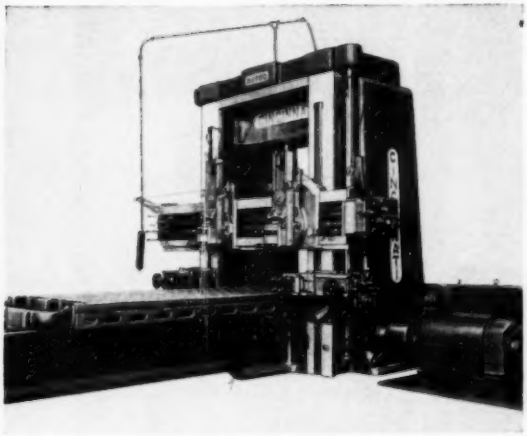
BULLETIN NO. 70FP46

GIDDINGS & LEWIS MACHINE TOOL COMPANY

FOND DU LAC, WISCONSIN, U. S. A.

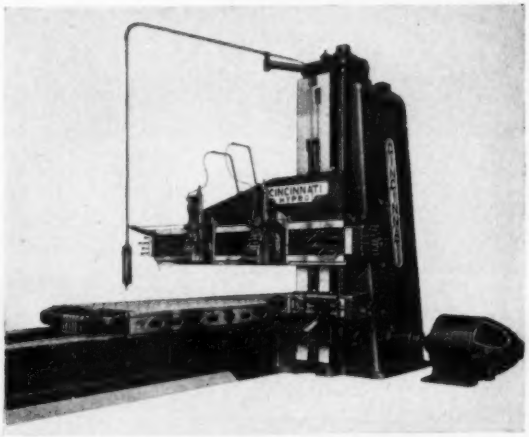
WITH THESE MODERN MACHINES

HYPRO **Planers, Vertical Boring and Turning Mills and Planer Type Milling Machines Fulfill Diversified Production Requirements in Metal Working Plants.**



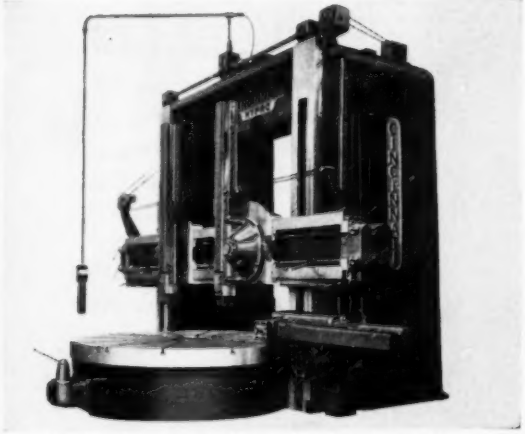
Standard and extra-heavy duty Double Housing Planers are available in sizes from 30" x 30" to 144" x 120". Each machine offers unexcelled Hypro features that improve work quality, increase production and lower planing costs.

BULLETIN NO. 138



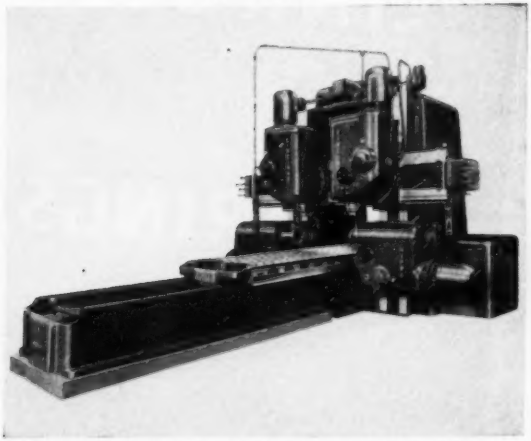
Operation from either side of the machine speeds work handling on Cincinnati Hypro Open Side Planers. Machines will square down in width from 132" to 36" capacity, offering ease and convenience to the operator.

BULLETIN NO. 112



Standard and extra-heavy duty Cincinnati Hypro Vertical Boring and Turning Mills are available in sizes from 54" to 16' swing capacity. These machines combine accuracy with low cost operation.

BULLETIN NO. 177



Planer Type Milling Machines are engineered for high production and easy adaptability on a wide range of general work. Electronic drive provides a smooth selection of feeds from the operator's pendant station.

BULLETIN NO. 106

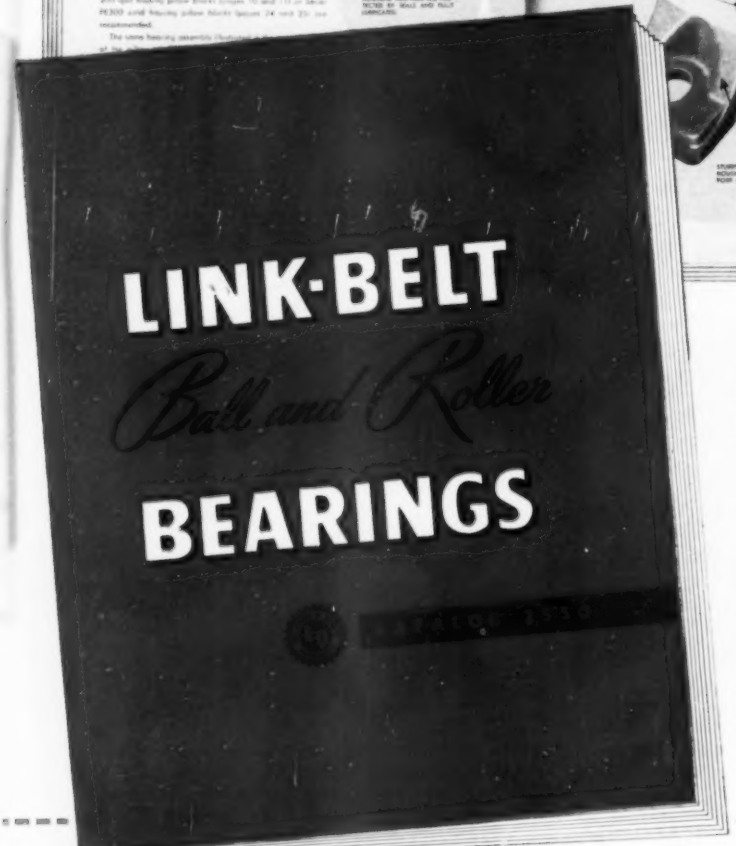
THE CINCINNATI PLANER COMPANY

(SUBSIDIARY OF GIDDINGS AND LEWIS MACHINE TOOL COMPANY)

CINCINNATI 9, OHIO, U. S. A.

HYPRO

YOUR COPY is Ready!



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Kaukauna universal DRILLING and TAPPING MACHINE

MODEL 140-U Universal Portable Drilling and Tapping Machine for Heavy-Duty Service.

A truly universal machine for heavy-duty drilling, tapping, boring and spot facing operations. Quickly adjusted at any angle—or compound angle—in any direction—at any location in the shop. Completely self-contained. Completely portable and readily moved to the toughest, most difficult, hard-to-get-at jobs.

extreme flexibility

- √ Column, rail and headstock move under power as a unit on the machine runway.
- √ These machine elements rotate on the column base duplicating the arm movement of a radial drilling machine.
- √ Vertical power movement of rail and headstock unit on column for high reach.
- √ Horizontal power traverse to headstock on rails at any angle to runway travel.
- √ Power swiveling of the headstock on trunnion in any plane through 360°.
- √ Power swiveling of trunnion on rails in vertical plane through 180° positions spindle quickly.
- √ Power and hand traverse to the spindle.

completely portable

Easily moved by overhead crane to the job. Does not require precision leveling. Eliminates the movement of large, heavy work to the machine. Reduces set-up time, labor and production costs.

Send for complete information on this new, heavy-duty machine which simplifies set-up and reduces tooling costs on production and job shop work. Details and specifications gladly supplied upon request.

The Complete Kaukauna Line includes:

MODEL 125-U	Universal Portable or Fixed Location Drilling and Tapping Machine for Medium-Duty Service with 2½" Spindle, No. 4 Morse Taper, 5 H.P. Drive.
MODEL 125-HR	Portable or Fixed Location Drilling and Tapping Machine for Medium-Duty Horizontal Work with 2½" Spindle, No. 4 Morse Taper, 5 H.P. Drive.
MODEL 140-U	Universal Portable or Fixed Location Drilling and Tapping Machine for Heavy-Duty Service with 4" Spindle, No. 5 or 6 Morse Taper, 10 to 20 H.P. Drive.
MODEL 140-HR	Portable or Fixed Location Drilling and Tapping Machine for Heavy-Duty Horizontal Work with 4" Spindle, No. 5 or 6 Morse Taper, 10 to 20 H.P. Drive.
MODEL 1030	Horizontal Portable or Fixed Location Drilling and Tapping Machine with Tilting Head for Medium-Duty Service with 3" Spindle, No. 5 Morse Taper, 7½ H.P. Drive.
MODEL 1040	Horizontal Portable or Fixed Location Drilling and Tapping Machine with Tilting Head for Heavy-Duty Service with 4" Spindle, No. 5 or 6 Morse Taper, 10 to 20 H.P. Drive.

KMC

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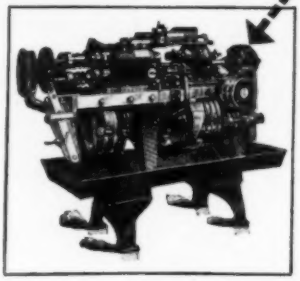
HITCHCOCK'S MACHINE TOOL LIST, JAN. 1906

"Acme Automatic"



The Wholesale Screw Machine

For quick, accurate work it has no equal. One set of tools only. **Four** bars simultaneously operated upon.

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Branch Offices: New York, Boston, Chicago
FOREIGN REPRESENTATIVES:
Alfred H. Schutte *Schuchardt & Schutte*

In 1906, the "Acme Automatic" was a sales leader—the first multiple-machine to produce small duplicate parts good enough and fast enough to reduce unit costs on the volume-produced, nationally-advertised products of the day—phonographs, washing machines, automobiles, "electrics", carriages and the like.

The old Acme Automatic is still a good machine—we find an occasional customer using one yet. *But it was not designed to produce today's parts, at today's costs for labor and materials.*

MODERN ACME-GRIDLEY AUTOMATICS are built in sizes:
Models RA-RB Bar Machine 9/16" to 5 1/8"—4, 6 and 8 Spindles.
Model RPA Chucking Machine 5 1/4" to 12"—4, 6 and 8 Spindles.

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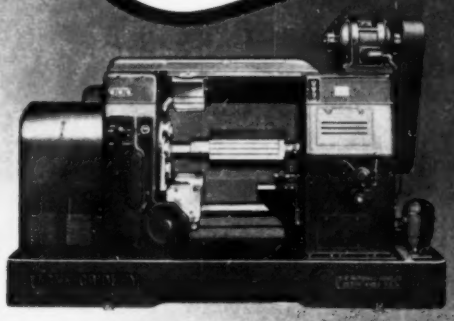
To produce 1949 models—and make a profit—you can't get by with 1906 methods and machines—or even those of 1940!

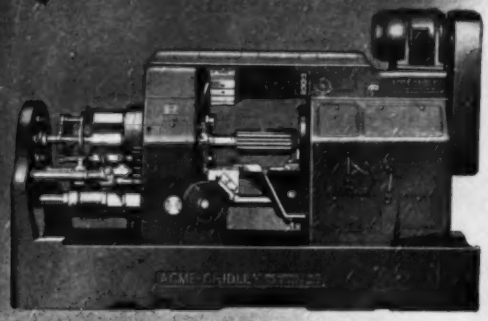
Any multiple spindle automatic that has not been continuously improved—improved in *strength*, in *precision*, in *adaptability*, in *output*—obsolete. Your competition is using equipment that will outproduce it, cut its production costs—and price you out of the market.

Forty thousand Acme-Gridley Bar and Chucking Automatics have a distinguished record over the years for lowering machining costs, to give you more good pieces in the pan at the end of each day. These time-proved records for production are no casual happenstance. They're based on a continuing policy of strict adherence to basic design requirements—ruggedness of frame, quick-change positive camming and, more recently, wider use of independent power-driven auxiliaries that eliminate many secondary operations.

Today's Acme-Gridley Automatics are built to give you *production*—as fast as modern tools will take it. With them you can meet *and beat* 1949 competition. We're prepared to quote them on the basis of guaranteed production figures. If your present machines are not postwar models it will pay you to make the comparison. May we help you?



Acme-Gridley Chuckers have a distinguished record for lowering production costs. Among their many moneysaving features is the wide, open tooling zone, permitting the use of independent power-driven auxiliaries that often eliminate secondary operations. Ask for bulletin CM43.



Acme-Gridley Bar Machines are known for their speed, stamina and adaptability. Rugged box-type frame, plus positive, close-coupled, quick-change camming provide a combination built for *speed*—as fast as modern tools will take. Ask for bulletin M45.

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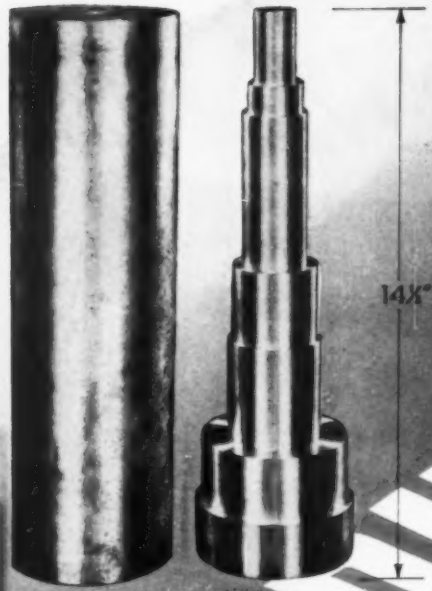
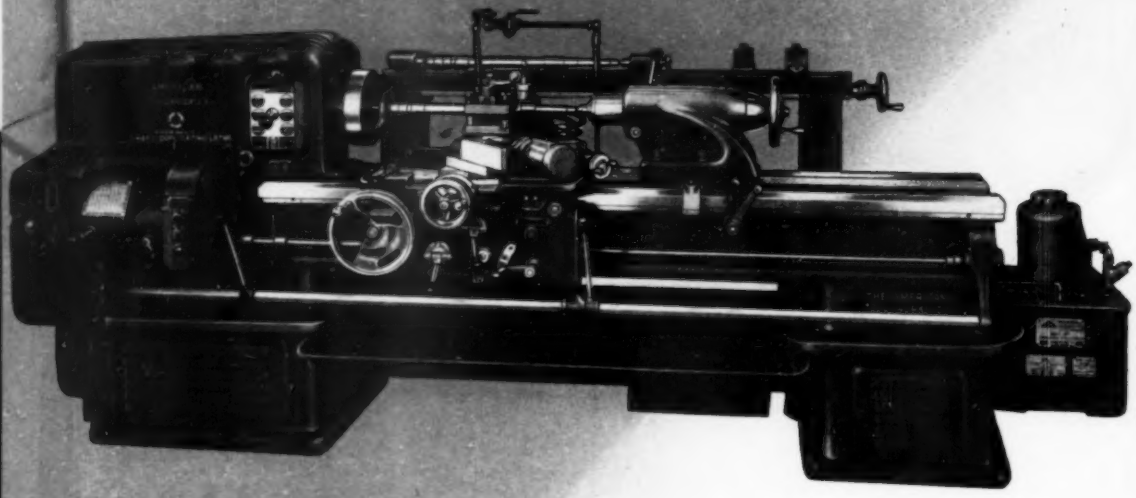


- Duplicator Time **14** Minutes
- Former Time **48** Minutes

Material.....4¼" SAE 4145
Depth of Cut.....½"
Speed.....285 r.p.m.
Feed.....018".
Total Time,
floor to floor...14 minutes.

PRODUCTION COSTS



THE AMERICAN TOOL WORKS CO.

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. . . by the new Hydraulic Duplicating technique introduced by "AMERICAN"

4¼" step shaft of SAE 4145 steel being machined complete in 14 minutes on 16-inch "American" "H S-D" Lathe.

The new "American" Hydraulic Shaft-Duplicating Lathe is a thoroughly engineered development for reproducing work shapes from a template by means of a hydraulically controlled cutting tool. The template holder and tracer head are built in at the rear of the lathe where they will not obstruct the operator's vision of the work or interfere with loading and unloading. All operating controls are located at the front of the lathe.

It is faithful and accurate in its reproduction.

It will reproduce steps, tapers, right angle and tapered shoulders, recesses, grinding necks and radii and is especially adapted to the production of such work as spindles, motor shafts, valve stems, back shafts, piston rods, axles—and a wide variety of chuck work having irregular contours.

A single hydraulic system is employed for operating the hydraulic tracer valve and the piston which controls the movement of the tool slide carrying the cutting tool. This simplicity is an outstanding feature and insures accurate reproduction, freedom from failures and elimination of work rejects.

This new metal cutting technique permits continuous cutting without interruption for measuring or calipering at feeds and speeds to the cutting limit of Cemented Carbide tools. "Miking" is confined to the first diameter only after which all other diameters are secured automatically.

This machine may be quickly converted to standard lathe operations.

Descriptive Bulletin No. 35 sent upon request.

Cincinnati, Ohio, U. S. A.

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VAN KEUREN FULL 2" GAGE

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WHICH GAGE WILL YOU BUY?

CATALOG AND HANDBOOK No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies are now free upon request.

Wire Type Plug Gages were originated by The Van Keuren Co. over 25 years ago. In 1948 this design was adopted in shorter lengths as the AGD standard for gaging holes from .030" to .510" diameter. The Van Keuren Co., because of years of pioneering, is able to offer the extra length at little or no extra cost.

You cannot afford to lose this extra length. When you need plug gages obtain a quotation from The Van Keuren Co.—Compare COST PER HOLE GAGED. You can be assured of quality and accuracy. A double inspection at the factory eliminates your inspection expense. No time will be lost waiting for replacements. You can count on prompt delivery from a stock of 2 million wires. Specify Van Keuren wire type gages and get the most GAGE for your GAGE DOLLAR.

Send for Supplement 19 showing quick and easy method of getting 4 to 10 gages from 1 VK wire type gage unit.

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CHROMIUM PLATE **VK CARBOLOY**
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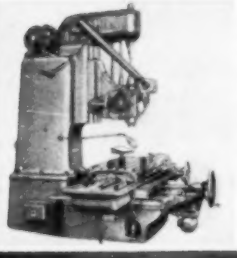
P&W VERTICAL SHAPER

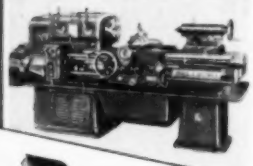
Justifiably termed "the handiest Machine in the Shop". Finishes hard-to-reach surfaces without need for special fixtures or change in setup.

P&W JIG BORER



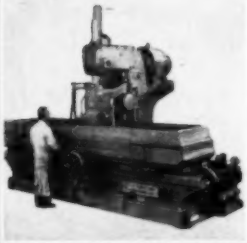
Locates its work with end measures, inside micrometers, dial indicators — bores at high speeds to precision limits — then checks its own work to "tenths". Key Machine for accurate location of precision-machined holes.

P&W MODEL "C" LATHE



Precision-built by and for master craftsmen. 12", 14" and 16" models in any bed length — all smooth, quiet, precise, powerful. Fulfilling every requirement for today's turning needs, they're "the Standard by which all fine Lathes are judged."

P&W VERTICAL SURFACE GRINDER



Satisfies today's need for high speed production. Rough-grinds and precision-finishes almost any material; hydraulic table drive provides exactly the right table speeds in infinite variations from 3 to 100 fpm. Three basic sizes: 14", 26", 30".

Pratt & Whitney

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

P&W

THE RIGHT TOOLS NOW

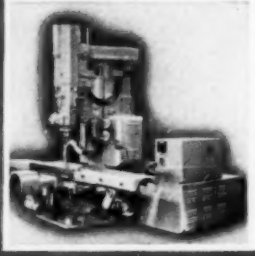
...AND EVERY FORWARD-LOOKING PLANT EXECUTIVE, SUPERINTENDENT AND ENGINEER TO REPLACE OBSOLETE EQUIPMENT WITH

*PRECISION TOOLS SPECIALLY BUILT TO MEET TODAY'S ALL-IMPORTANT NEED:

Productivity with Economy

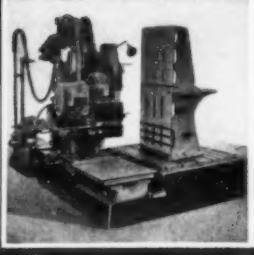
Any one of these precision Machine Tools has the ability to provide lastingly accurate performance . . . the result of Pratt & Whitney's rigid standards of materials and craftsmanship. With these Machine Tools you can plan for today's and tomorrow's metalworking needs with complete confidence.

P&W JIG GRINDER



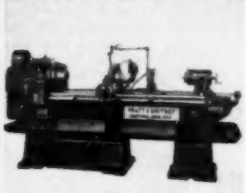
End measures, inside micrometers, dial indicators are "built-in" for precision-grinding of straight or tapered holes to "tenths" limits on spacing, diameter, depth. A cost-cutting toolroom essential for jigs, fixtures, dies and small-lot production.

P&W KELLER MACHINE



Extraordinarily sensitive tracer-controlled Milling Machine. Automatically, economically machines dies, molds, patterns or production-pieces from master forms or templates. Choice of models for various sizes of 2-dimensional profiling, or intricate 3-dimensional work.

P&W THREAD MILLER



This Model "C" Machine features a high degree of precision with full economy in heavy production thread milling . . . faster cutting speeds, finer finishes, longer tool life. Available in 4½", 6" and 12" diameter capacities and various bed lengths.

Space does not permit presentation of the full line of P&W Machine Tools. Complementing those illustrated are the following, each a key tool designed by capable, experienced tool engineers and built by precision-trained craftsmen to fulfill today's all-important need: precision *plus* productivity *plus* economy . . . DIAFORM ATTACHMENT—BENCH LATHE — BENCH MILLER — DIE SINKERS (Plain and Universal) — AUTOMATIC DUPLICATING MACHINES — AUTOMATIC LATHE — AUTOMATIC CENTERING MACHINE — GEAR GRINDERS — CUTTER AND RADIUS GRINDERS — PLAIN, TILTING AND VERTICAL ROTARY TABLES — KELLERFLEX FLEXIBLE SHAFT MACHINE with a full line of accessories, Carbide Burs and DI-BURS.

Detailed literature on each P&W Machine Tool will be mailed upon request — or inquire at the nearest P&W Branch Office.

...FOR COMPETITIVE *1950*

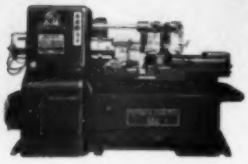
Also AUTOMATIC TURRET LATHES See next page

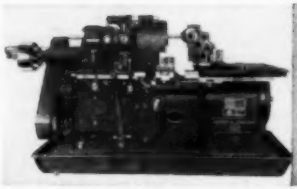
FOR TODAY'S ALL-IMPORTANT NEED:

Productivity with Economy

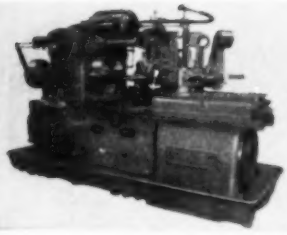
P&J TOOLING ON AUTOMATICS

3U Speed-Flex
Newest P&J development—a small high speed machine for machining castings and forgings up to 6" diameter, 4" long — spindle speeds up to 1445 R.P.M.



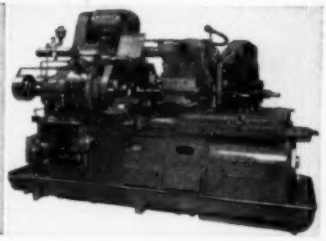


4D Automatics
Made in two sizes (standard and elevated) with spindle speeds up to 696 R.P.M.—suitable for machining castings and forgings up to approximately 10 inch diameter.

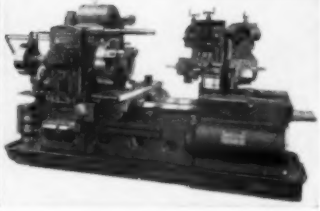


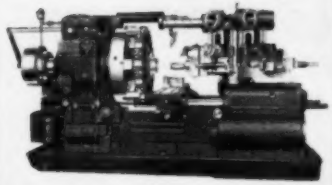
5D Power-Flex
Built in three sizes (standard, elevated and elevated with long travel). Suitable for work up to about 14" diameter with spindle speeds up to 610 R.P.M.

5D-2 Power-Flex
Two spindle machines built in three sizes capable of high production machining of work up to 7", 10" and 13" diameters respectively.

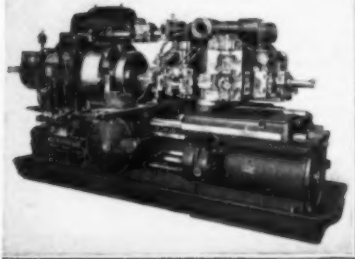


6D Automatics
Available in three sizes and combinations of swings, travels and bed lengths . . . suitable for machining castings and forgings up to 18" diameter and 20" long.





6-DS Automatics
Heavy duty powerful machines (two sizes) for large castings and forgings . . . headstock capable of handling 60 H.P. swings over cross slide 21" (6-DS) and 27" (6-DSE) 13" turret feed.



8-DT Automatics
Equipped with special heavy duty cross slide . . . 60 H.P. headstock . . . swing over cross slide 23" . . . turret feed 16" . . . for large castings and forgings.

Potter & Johnston Company
Pawtucket, R. I.
subsidiary of Pratt & Whitney
Division Niles-Bement-Pond Company

P&J AUTOMATIC TURRET LATHES

"Here's what I count on ... to keep me on top of my job!"

JOE, here, has a mighty dependable assistant in this Veeder-Root High-Speed Predetermining Counter. He pre-sets one bank of wheels to the exact number of pieces he needs on any run. Then he starts his high-speed machine *and forgets it* . . . or does other work! No nerve-strain. No eye-strain. No guesswork. *And no waste* . . . for the counter signals him or acts to stop the machine right on the button, without either shortage or surplus.

Yes, among the many economies and advantages of Veeder-Root Counters, you can count on them to boost workers' morale and keep it at high level. That's one of the reasons why management and plant operating heads are coming more and more to specify production machines and equipment featuring *built-in* Veeder-Root Counters. And *that's* why it's smart salesmanship to build Veeder-Root Counters into *your* product . . . to bring a new utility to your customers. But how to do it? That's for us to show you. Just write.

VEEDER-ROOT INCORPORATED, HARTFORD 2, CONNECTICUT

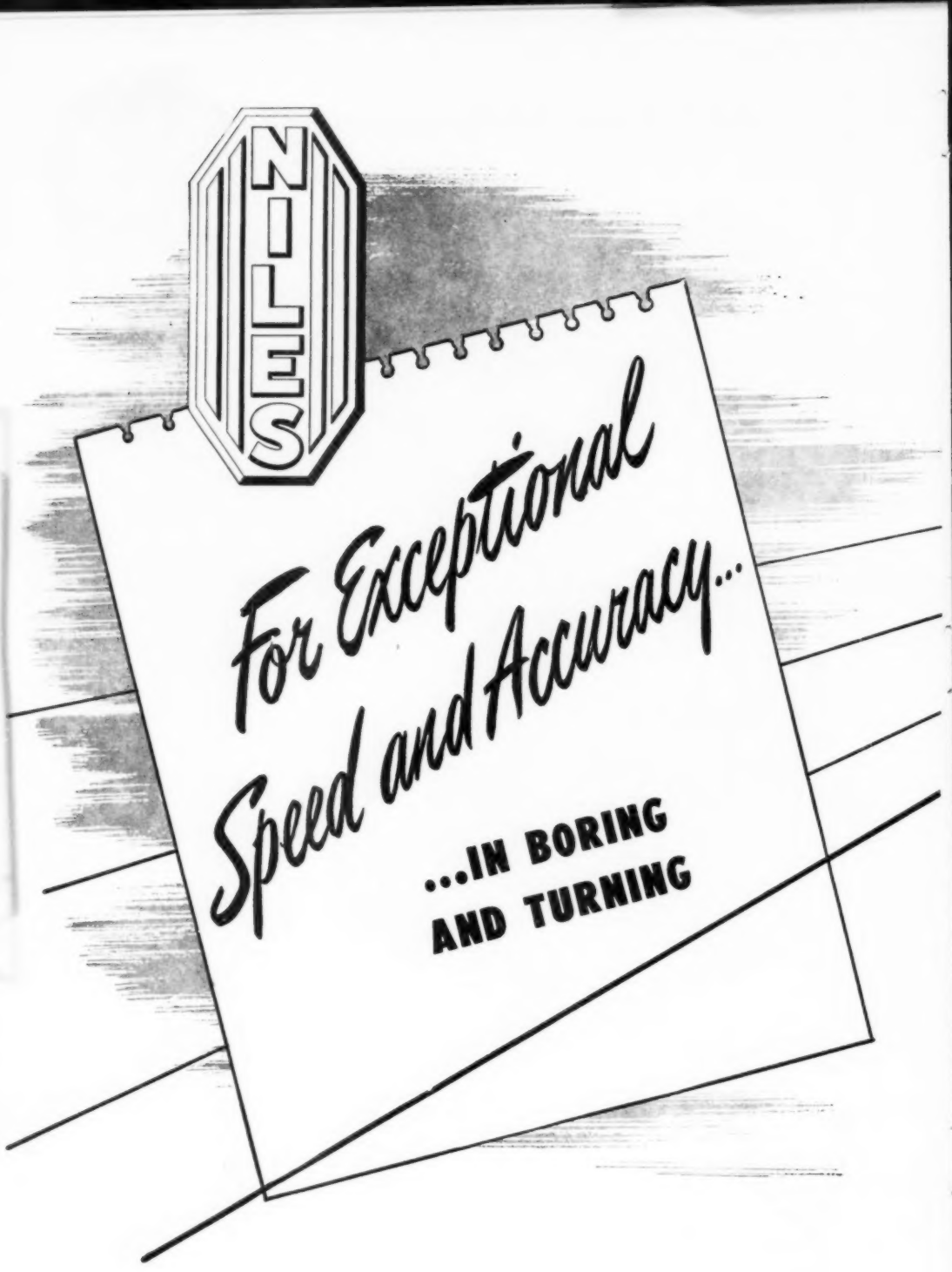
No. 1239

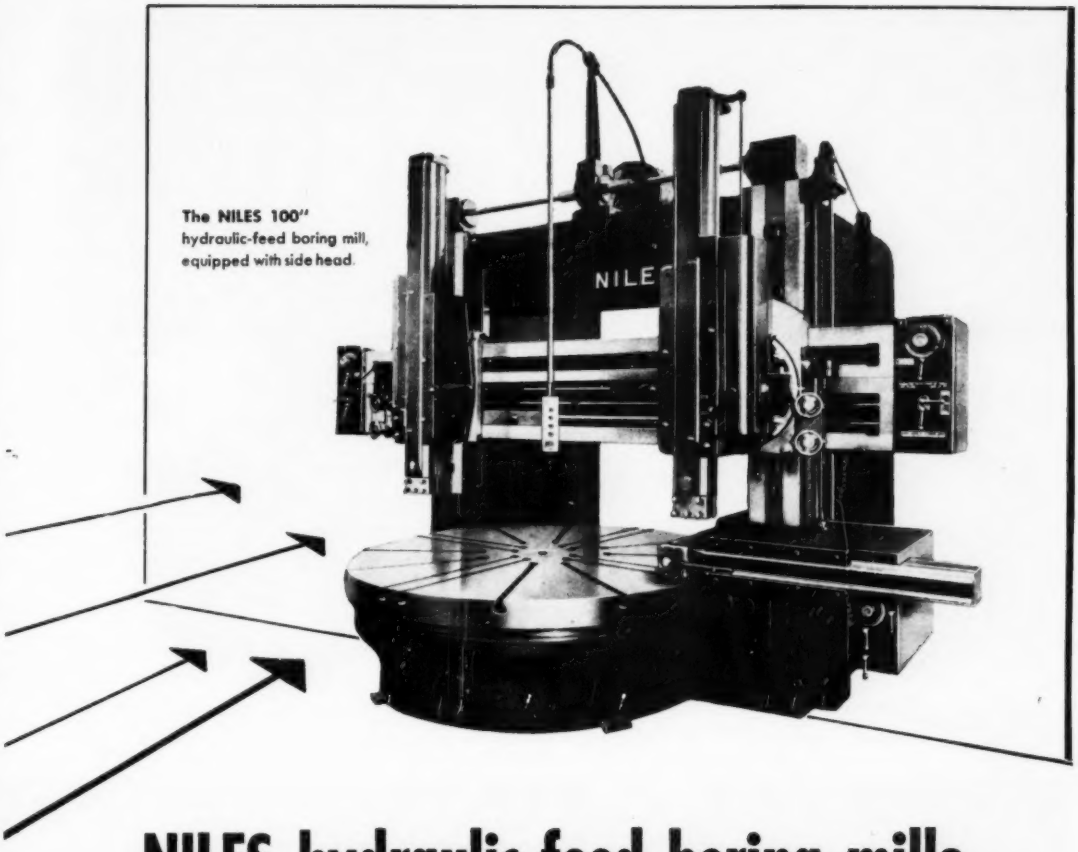
HIGH-SPEED PREDETERMINING COUNTER

is furnished with electrical contact or mechanical knock-off lever. Speeds up to 2500 counts per minute. This is one of scores of V-R Standard Counters. Write for 8-page Condensed Catalog to Veeder-Root Incorporated, Hartford 2, Conn.

Veeder-Root COUNTERS

In Canada: Veeder-Root of Canada, Ltd., 955 St. James Street, Montreal 3
In Great Britain: Veeder-Root Ltd., Kilspindie Rd., Dundee, Scotland


NILES
For Exceptional Speed and Accuracy...
...IN BORING AND TURNING



The NILES 100" hydraulic-feed boring mill, equipped with side head.

NILES hydraulic-feed boring mills

Massive construction of Niles boring mills assures ample rigidity to take the stresses of high-speed cutting – yet with no loss of accuracy. You will get considerably faster boring and turning, particularly with tungsten-carbide tools.

With fingertip control of the hydraulic feed, your operator can effortlessly and efficiently operate his mill. He has, for example, infinite feed selection while the machine is running – he can make fast tool placements. Reduced operating fatigue will tend to improve his accuracy.

Eighty years of building large boring mills stand behind these new Niles machines. You will find them precision products in every respect, designed to give you better production – consistently.

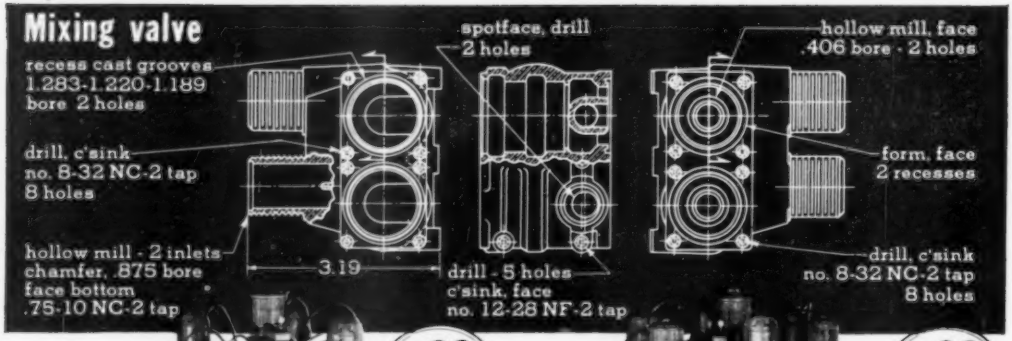
* * *

Niles Vertical Boring Mills are built in all standard sizes from 72 inches up, with either hydraulic or mechanical feed and with or without side head. For further information, call the Lima-Hamilton sales offices in New York, Chicago or other principal cities, or write directly to Lima-Hamilton Corporation, Hamilton, Ohio.

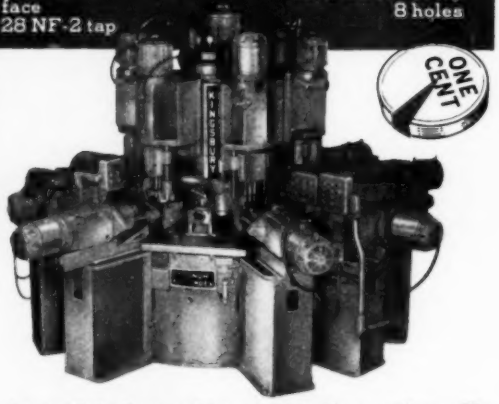
LIMA HAMILTON CORPORATION

DIVISIONS: *Hamilton, Ohio* – Niles Tool Works Co.; Hooven, Owens, Rentschler Co. *Lima, Ohio* – Lima Locomotive Works, Inc.; Lima Shovel and Crane Division. *Middletown, Ohio* – United Welding Co.

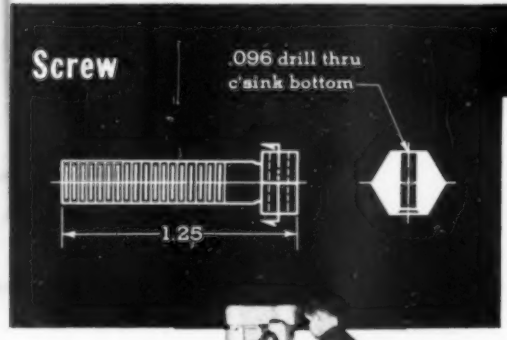
PRINCIPAL PRODUCTS: Niles heavy machine tools, Hamilton diesel and steam engines, Hamilton heavy metal stamping presses, Hamilton-Kruse automatic can-making machinery, Locomotives, Shovels and cranes, Special heavy machinery, Heavy iron castings, Weldments.



A horizontal indexing machine with central column has 16 units that perform the operations above at the left. The machine has a 60-inch power index table with 12 stations. 30 spindles. 475 parts an hour gross. 7/100¢ per operation.



A second similar machine completes the operations. The central column supports 6 vertical units, and knees bolted to the base 11 horizontal units. Bushings guide the drills. 45 spindles. 462 parts an hour gross. 5/100¢ per operation.



Accurate operations

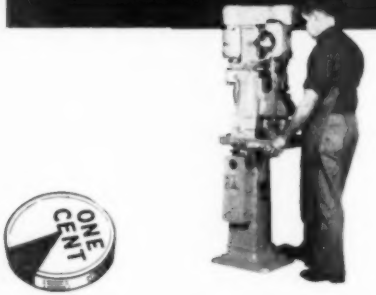
Man and machine together cost a fraction of 1¢ per tool per part. On the simple job at left only 10/100 of 1¢. On the complex job above only 6/100 of 1¢. For that fraction of a penny every part is uniform, and every operation is in exact location.

Many all-purpose machines can do these operations. But none can match the cost. Few can match the accuracy and uniformity. Here is why:

More output per man hour. One machine performs many operations at a high production rate.

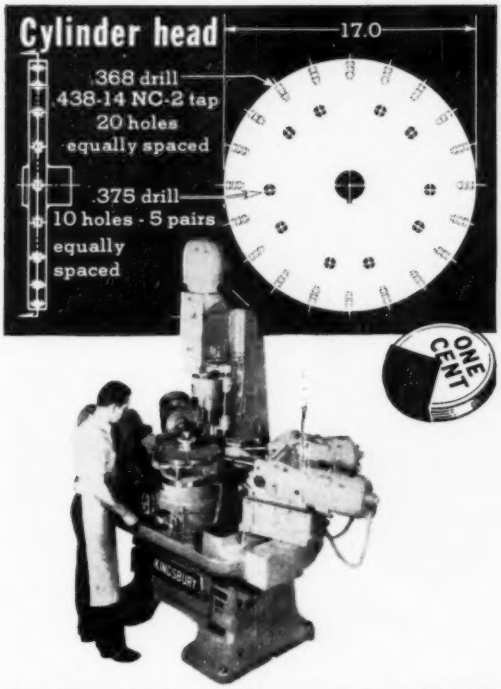
Uniform product. Automatic work cycles never vary. Fixtures that index are exact duplicates.

Accuracy. No handling or relocating of work until finished. Bushings guide drills and reamers.

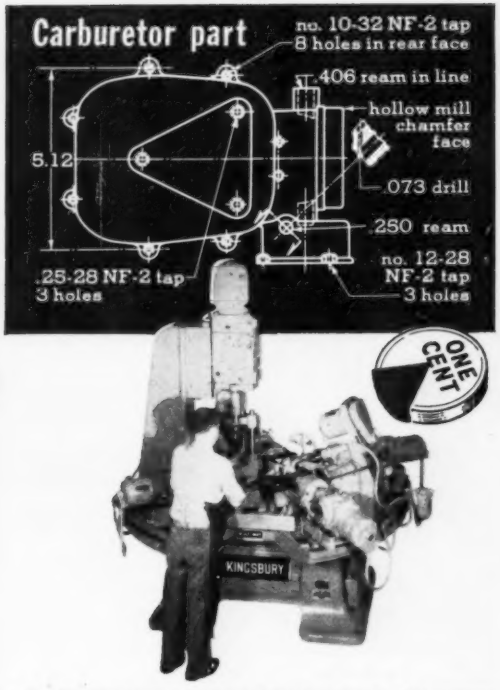


A vertical machine has a drilling unit, a countersinking attachment underneath and a V-block fixture with automatic ejection. The operator merely loads. The rest is automatic. 2 spindles. 1440 parts an hour gross. 10/100¢ per operation.

KINGSBURY



An indexing fixture rotates one part on its axis 36° each index. Two pairs of units drill and tap 20 holes. One unit with 2-spindle head drills two .375 holes every other index. 6 spindles. 24 parts an hour gross. 27/100¢ per operation.



A multi-way non-index machine has 7 units that operate from 5 directions in 2 chuckings. The operator changes parts in one fixture while units operate on a part in the other. 18 spindles. 150 parts an hour gross. 16/100¢ per operation.

at amazing low cost

Less handling, less space. Fewer machines.

Superior construction. We use 11 jig borers, 9 boring machines, homocarb and relieving furnaces, induction heater, gear shaver, thread grinder, etc.

Short pay-off period. Usually 1 to 3 years.

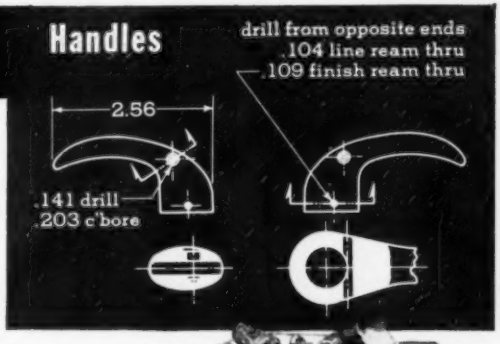
Proposals. If you have a high production job with operations like these, ask our Mr. L. A. Carll for a proposal on a tooled machine. Send him a print showing the operations and hourly output you need. Free bulletins show 40 setups. Kingsbury Machine Tool Corp., 20 Laurel St., Keene, N. H.

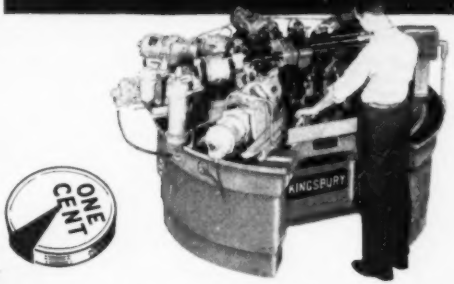
(For every cost here we figured on a generous wage rate. We assumed the machine would run at 80% efficiency for 6000 hours, a fraction of its useful life. No power or overhead.)

83

AUTOMATIC DRILLING AND TAPPING MACHINES

for Low-Cost High Production





A horizontal indexing machine has 6 units with 2-spindle heads. Each works on a left and a right hand part at the same time. Clamping, unclamping and ejection is automatic. 12 spindles. 642 pairs an hour gross. 7/100¢ per operation.

6

ELECTRONIC HEATERS ON THE JOB: SILVER BRAZING

stronger joints simplified design savings per hour: $2.25

Beater twisted to destruction shows that the brazed joint holds even though the stem gives way.

BETTER BEATER BLADES . . .

are being built by the Hunter Spring Company, Lansdale, Pa., as a direct result of putting a 20-kw electronic induction heater on the job.

Six beater blade sub-assemblies are placed in a jig. Flux and silver brazing alloy are placed on the sub-assemblies at the point where the four blade ends come together. The beater stems are then locked into position over this point.

The jig positions the assemblies in the work coil of the heater and in a matter of seconds the joint between the stem and blades is brazed. The heater then *automatically* transfers power to a second set of inductor coils which brazes batter guards to the stems. After the heating cycle, the beaters are passed on for finishing operations.

The brazed beaters are stronger than their riveted predecessors; design has been simplified so that now only four components are used whereas the riveted beaters used six components; rejects have been substantially reduced; and a production cost saving of $2.25 per hour has been effected!

Net result: a better product at lower cost through electronic induction heating.

SEND FOR YOUR FREE COPY!
"Induction Heating in Industry"

Just off the press, it shows how dozens of manufacturers have put G-E electronic induction heaters on the job to cut costs and speed up production.

Sect. C720-12, Apparatus Department, General Electric Co., Schenectady 5, New York.

Please send me GEA-4945, *Induction Heating in Industry*.

Name .....

Company .....

Address .....

City ..... State .....

YOUR PRODUCT AND INDUCTION HEATING

If you are annealing, brazing, soldering or hardening parts of your product, you can very likely do the job better, faster, and at lower cost with G-E electronic induction heaters. Just contact the G-E Sales Office nearest you; we'll be glad to recommend the cost-cutting equipment best suited to your particular heating requirements.

You can put your confidence in—

GENERAL ELECTRIC

Which of these rust preventives will solve your problem?

• Here are the new Stanorust Rust Preventives! Scientifically developed, thoroughly tested, proved in service . . . they are offered to you as the means to more economical and effective rust prevention in your plant. From this wide selection of grades, you can choose the Stanorust that meets your protection requirements.

STANORUST NO. 3-FP is a fingerprint remover. It can be used to remove the cause of fingerprint corrosion and deposit a protective film in one simple dipping operation.

STANORUST NO. 4-V has a Stoddard solvent base which evaporates to leave a thin film for temporary rust prevention. It is particularly outstanding for suppression of corrosion due to fingerprints.

STANORUST NO. 12 provides economical protection under average indoor conditions. It can be applied cold by conventional methods.

STANORUST NO. 95 is designed for protection of parts in moderately severe indoor storage. It has a viscosity about equivalent to an SAE 40 Motor Oil. It can be applied cold by conventional methods.

STANORUST S-1 is a semi-fluid product, designed to give protection over a longer period than the No. 95 grade. It is suitable for outdoor service, if protected parts are under cover. This grade should be heated for most economical application.

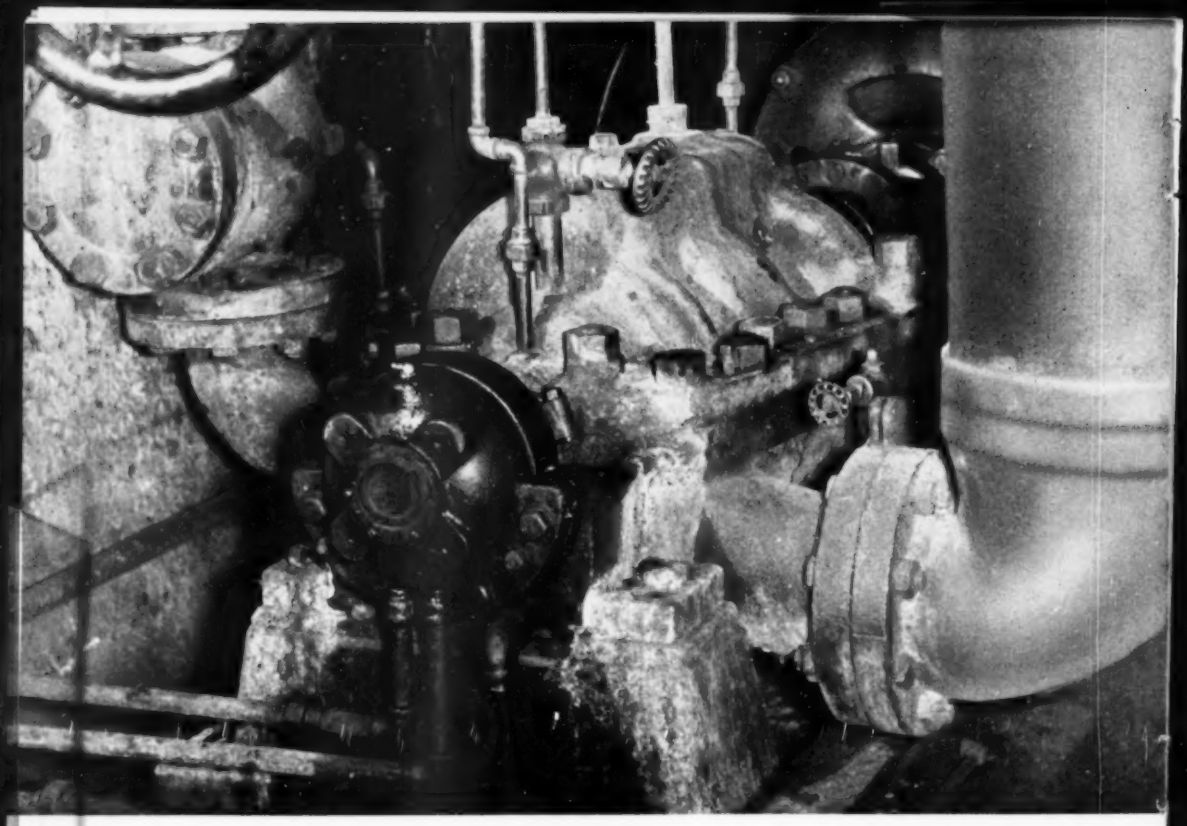
STANORUST 1-XC is a non-fluid product which is recommended for protection of parts under severe outdoor conditions. Because it has been thinned with a volatile solvent, it is applied cold with a swab or a brush.

STANORUST 3-X offers protection against severe inside storage conditions and moderately severe outdoor conditions. It is soft enough to be applied cold.

STANORUST 6-X is a heavy petrolatum-type, adhesive product that protects against the most severe outdoor exposure. It meets government specifications which include a requirement that it protect against corrosion for a period of not less than 10 years without renewal. Application is made by swabbing or dipping at a temperature of 150° to 180°F.

For more complete information about these new products, write for your copy of the Stanorust booklet. Address your letter to Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD



Pump puts the "heat" on grease

HEAT from the shaft of the boiler feed pump shown above kept a conventional grease in plenty of trouble. The severe conditions caused the grease to oxidize and gum up on the pump's ball bearings. Consequently, the bearings overheated. Grease had to be applied every few hours. The pump had to be shut down frequently so that the bearings could be cleaned.

Officials of this plant put their problem to a Standard Oil Lubrication Engineer. The Engineer recommended Stanolith Grease No. 57, a lithium-soap product with the unique ability to withstand both heat and water.

On the bearings, Stanolith stood up under the high temperatures. It would also resist any water washing should leaks develop. Over-heating troubles were stopped. Downtime was eliminated. Instead of the previous daily greasings, only one application of Stanolith was required each week—an important saving of both lubricant and labor.

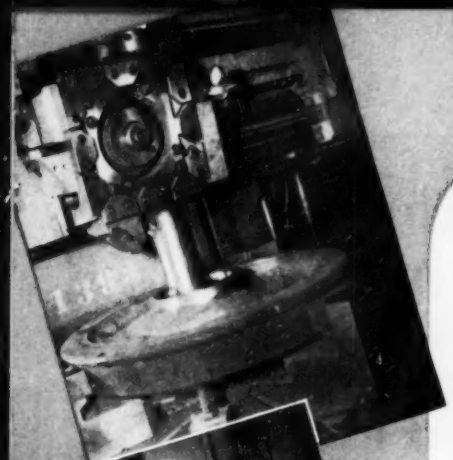
Lubrication problems caused by heat, water, or low temperatures in your plant can be solved by this *one* lubricant: Stanolith Grease. Through its remarkable versatility, you can avoid the cost and trouble of stocking and using a variety of special greases. A Standard Oil Lubrication Engineer will help you make these savings.

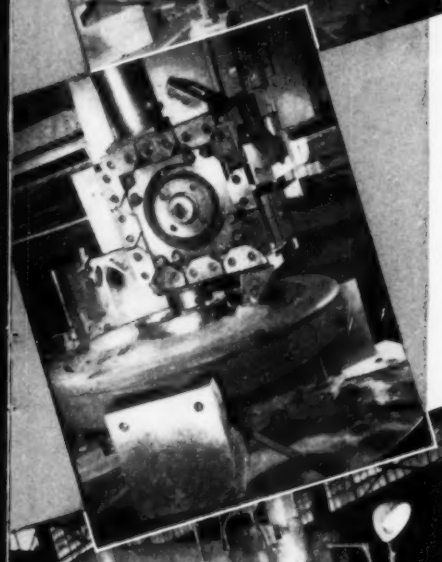
Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

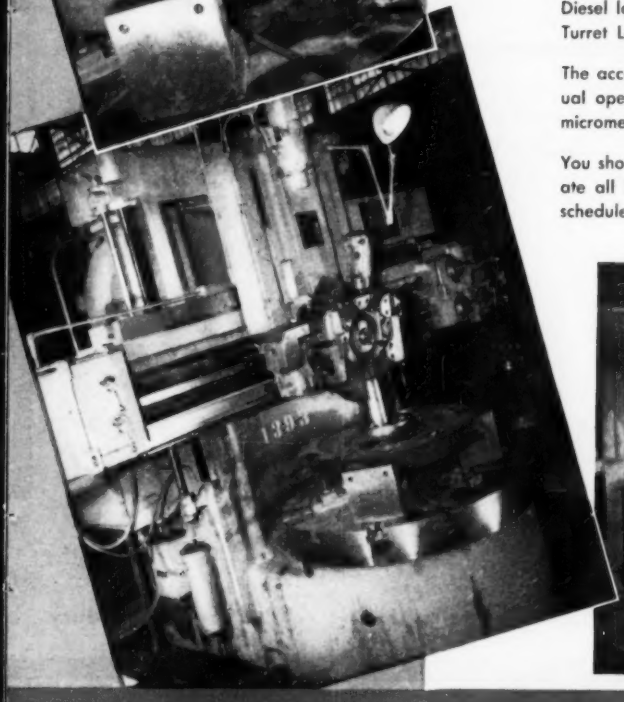
PROBLEM SOLVED BY...

Stanolith Grease

STANDARD OIL COMPANY (INDIANA) STANDARD







BULLARD

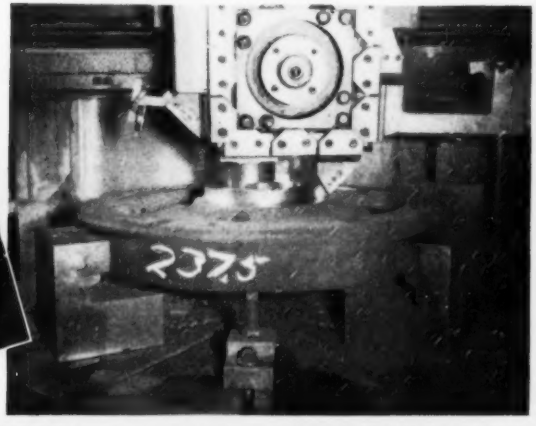
MAN-AU-TROL

Boosts Diesel Wheel Production 200%

THE greater use of Diesel-Electric power in freight and passenger service has placed an exceptionally heavy demand on the shops for Diesel wheels. This demand must be fulfilled without delay because Diesel motive power is too costly to be held out of service for wheels. Availability of this equipment must be kept high for greatest economy. Here is the way the Boston and Maine Railroad solved this problem. A Bullard 54" Man-Au-Trol Vertical Turret Lathe was installed in the North Billerica, Massachusetts, shops. This machine has tripled the production and improved the accuracy of boring and turning Diesel locomotive wheels over the previous 54" Bullard Vertical Turret Lathe.

The accuracy of this class of work cannot be matched by manual operation. Tool wear is even compensated for by manual micrometer adjustments of Man-Au-Trol detector switches.

You should know all about the Bullard Man-Au-Trol to appreciate all it can do to lower unit costs and "pep-up" machining schedules. *Write for information today.*

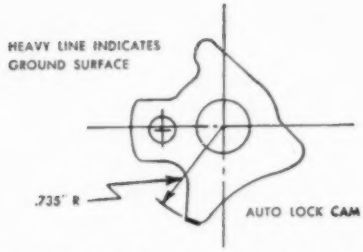


THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

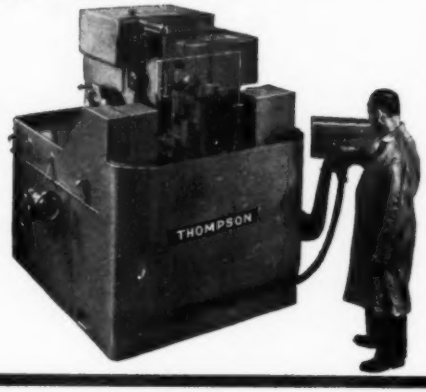
HERE'S HOW

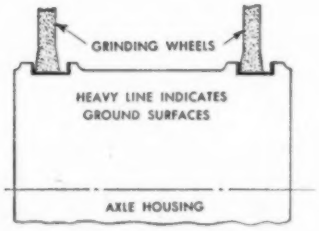
Adaptable New Thompson Surface Grinders Prove...



Thompson Truformatic mass-produces simple or intricate contours. Pushbutton control starts completely automatic cycle of operation, permitting operator time to load and unload the 160-part fixtures and assuring both accuracy and steady speed. Truformatic finishes 160 parts per cycle, 4,000 parts per hour. Available in sizes and capacities to meet various mass-production small-part requirements.

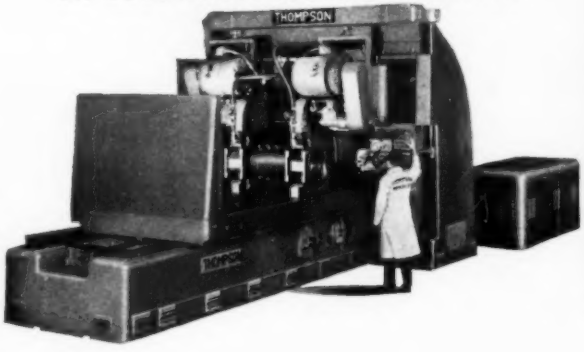
TRUFORMATIC CONTOUR GRINDS AUTOMOBILE LOCK STAMPINGS—
4,000 PER HR.





Thompson Hydrail grinder (widest surface grinder built) reduces finishing time on massive diesel locomotive bearing housings and grinds to a tolerance of .0008" over 72" x 120" area. Machine illustrated is 72" x 36" x 120". In other industrial applications can sharpen large dies thus eliminating stripping down and assuring that all surfaces will be in correct relation. Horizontal or vertical wheel heads or both available.

HYDRAIL GRINDER DOES
3-DAY JOB IN 2 HOURS
ON LOCOMOTIVE BEARING HOUSINGS

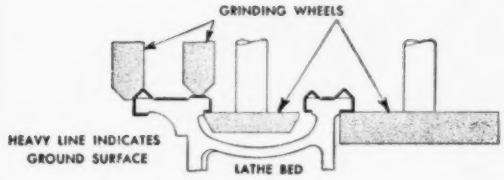


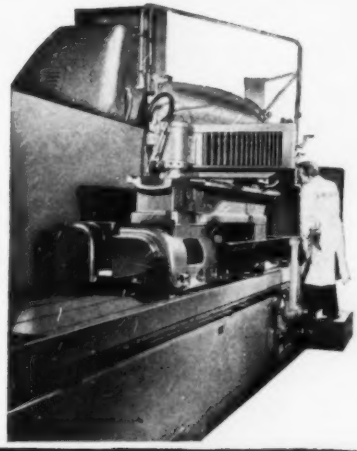
The only manufacturer of a complete range of heavy duty and light duty

The Thompson Grinder Company,

LOWER COSTS

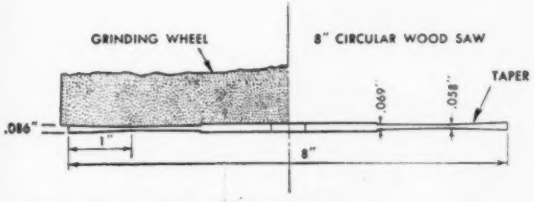
CAN BE OBTAINED FOR A WIDER RANGE OF INDUSTRIAL APPLICATIONS

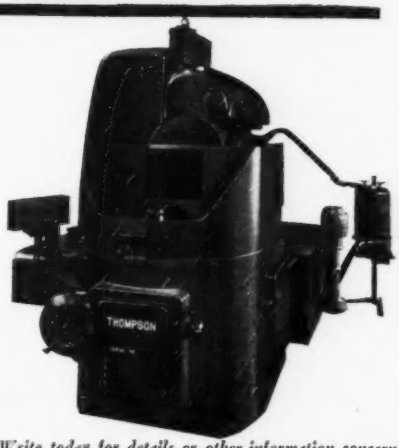




DOUBLE SPINDLE WAY GRINDING MACHINE REDUCES FINISHING TIME 400%

This Thompson 30" x 48" x 196" Type CX Grinder with horizontal and vertical spindles grinds Vees and Flats on a lathe bed in one fifth the time formerly required. Tolerance is .0005 end to end over 20 ft. Note base is attached—grinding of already assembled machine removes possibility of deformation caused by tightening bolts in assembly.





TRUFORMING MACHINE GRINDS CIRCULAR WOOD SAWS IN 300% LESS TIME

This Thompson Circular Saw Truforming Machine grinds 8 inch high carbon steel wood saws in 2½ minutes. Formerly this job required 2 operations and 8 to 10 minutes on a circular single chuck grinder. Machine is available in 6 to 12 inch and 6 to 16 inch sizes.

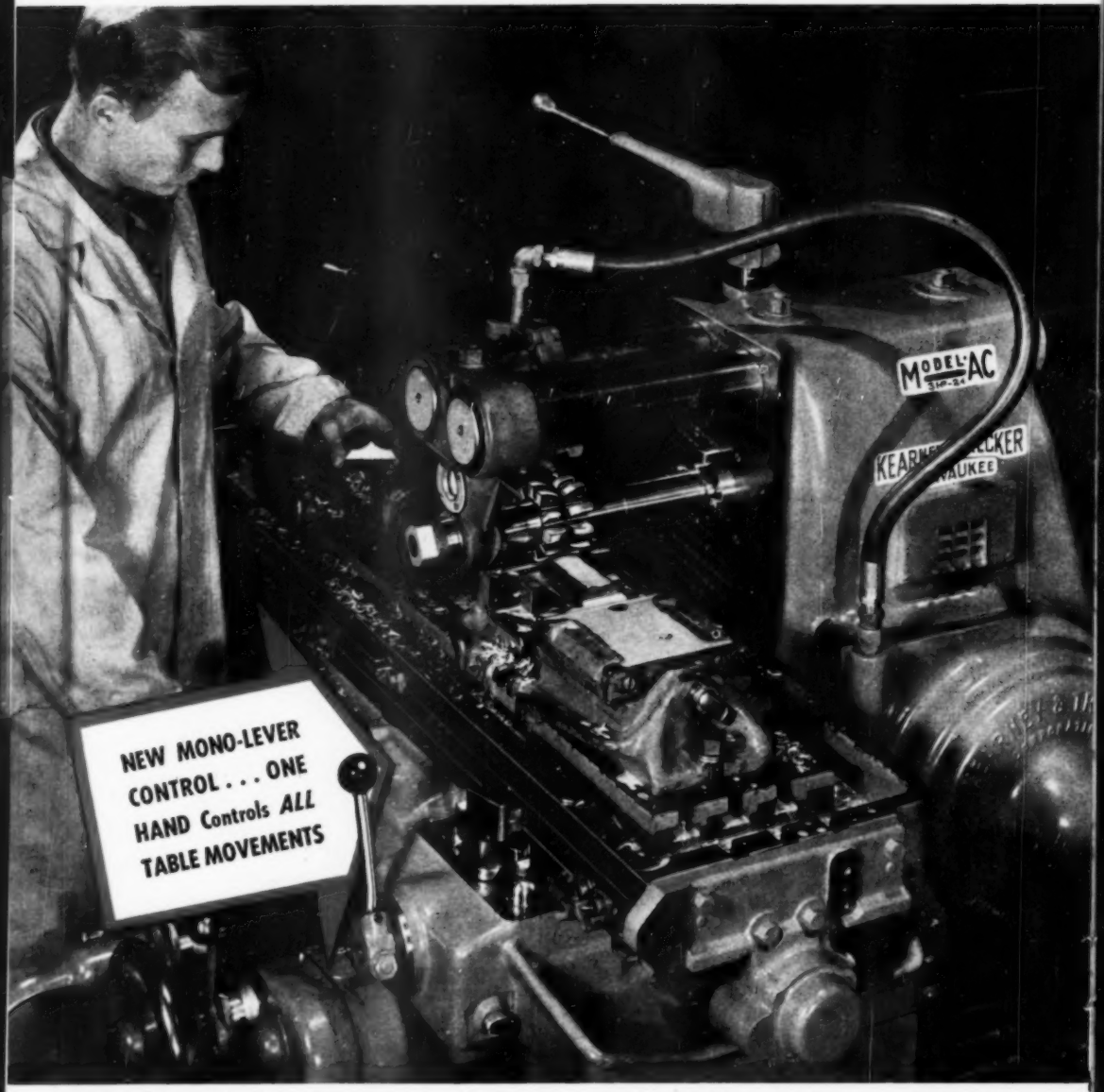
Write today for details or other information concerning possible application of Thompson Surface Grinders in your production work.

surface and contour grinders for industry

Thompson SURFACE Grinders

Springfield, Ohio

Now in the 3hp range..FOUR NEW MACHINES FEATURING



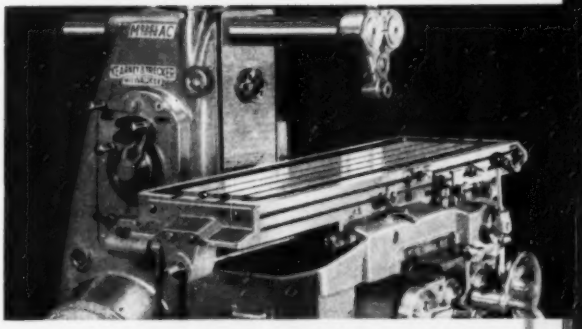
Camera study of good management at work! The job — form mill two radii on medium steel wedge plates. Fine finish required. With new Kearney & Trecker 3hp Model 24-AC machine, operator sets up automatic table cycle for reciprocal milling and easily paces production using climb and conventional milling alternately. RESULT: 28% savings in loading time, reduced scrap, more uniformity, less operator fatigue.

KNEE-TYPE MILLING MONO-LEVER CONTROL

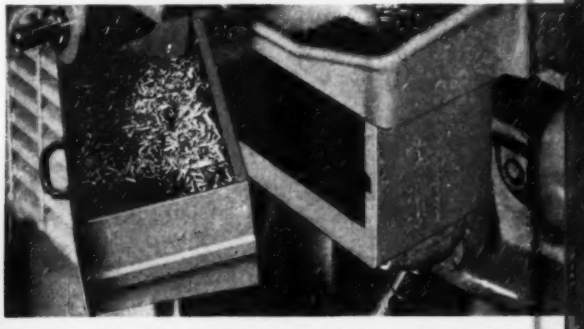
YOU asked for them — Kearney & Trecker milling machines in the 3hp range with Mono-Lever Control and Automatic Table Cycle. Here they are — your choice of two different styles, plain or vertical with either 18" or 24" table feed.

These machines offer you features never before available on machines of this size and type: 33% larger table working area plus built-in deep-well coolant troughs all around — extra large (2" dia.) precision-ground table screw with adjustable nut to eliminate backlash — drawer-type chip containers for easy chip removal — positive metered lubrication of the saddle and table ways and table feed mechanism—six-way power rapid traverse — automatic spindle stop — and quick-change feed and speed selection.

Don't wait. It costs you nothing to find out today about these new machines. See how they can meet all around big or small job requirements in your shop. For detailed information call our nearest representative or write direct to Kearney & Trecker Corporation, 6784 West National Avenue, Milwaukee 14, Wisconsin.

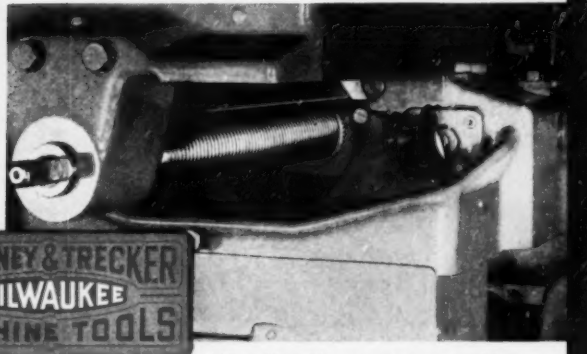


You get 33% more table working area on these new machines — 38" x 14" on Model 18-AC and 44" x 14" on Model 24-AC. This means greater adaptability to handle more jobs.



Convenient, removable drawer-type chip containers simplify chip control and "housekeeping" on the job — improve working conditions for operator—screen chips from coolant return.

New 3hp Model 24-AC plain style Kearney & Trecker milling machine featuring Mono-Lever Control and Automatic Table Cycle . . . ask about it or the vertical style equivalent today!



Adjustable table screw nut on precision-ground 2" diameter screw eliminates backlash—makes climb or conventional milling equally easy . . . assures uniform, accurate results.

Help for You

IN YOUR PRODUCTION PLANS - - - -

Eliminate THE PROBLEM OF PARTS PRODUCTION AND CUT YOUR COSTS BY EMPLOYING BURGESS-NORTON SERVICE AND FACILITIES - - - - - -

Burgess Norton

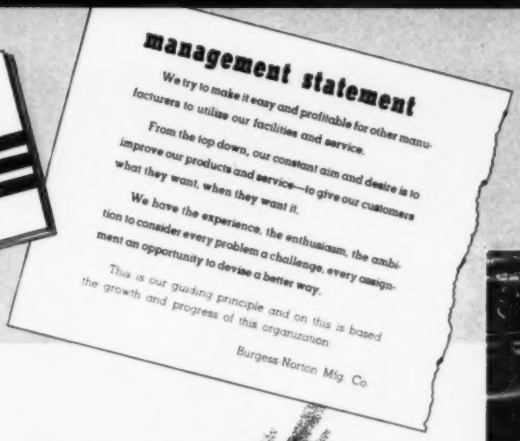
MFG. CO. GENEVA, ILLINOIS

Est. 1903

We specialize in the work of producing precision-made parts of all types and sizes for manufacturers. Therefore we become an auxiliary plant to such as yours because we take your parts problems from you and save money for you in so doing.

Your assurance of top quality, economical parts for your products lies in the completeness of our modern plant. Here there is no split responsibility for design, development and manufacturing to increase costs or jeopardize quality. A Burgess-Norton part is a completely finished part, carried through every phrase of production necessary for a product component of sound design.

A Few of the Many Products We Have ade for a Variety of Manufacturers - - - ry Case We Obtained the Business of Cost Savings and Better Quality



management statement

We try to make it easy and profitable for other manufacturers to utilize our facilities and service.

From the top down, our constant aim and desire is to improve our products and service—to give our customers what they want, when they want it.

We have the experience, the enthusiasm, the ambition to consider every problem a challenge, every assignment an opportunity to devise a better way.

This is our guiding principle and on this is based the growth and progress of this organization.

Burgess-Norton Mfg. Co.

• Our 30-page booklet entitled "Working Together" gives you a quick picture of our history, cooperation, facilities and ability. We think you will be interested in looking through this booklet. It should prove most helpful to you as you plan for further modernization. May we send it to you?

12 DEPARTMENTS---full[y] modernized to give y[ou] precision results with saving[s] [in] costs

We have made parts for—Auto[mo]
Compressors—Harvesting Machin[es]
for Boats—Pumps—Cranes—Ref[rig]
Well Equipment—Conveyors
Electric Railway Cars—
other equipment, so

We take great pr[ide]
and solicit the [op]portunity to serve you who depend upon [us] for quality and cost savings.

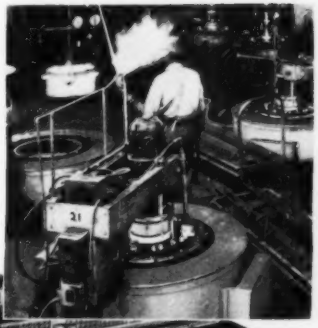
AUTOMATIC SCREW MACHINE DEP'T

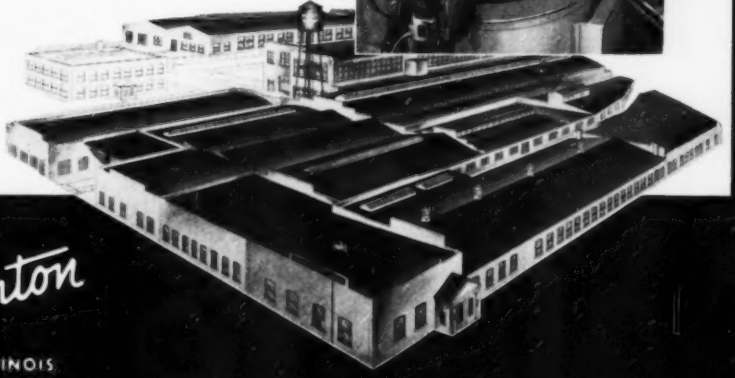
PRESS DEP'T

HEAT TREATING DEP'T

OTHER DEPARTMENTS
to serve you

- Engineering
- Grinding
- Broaching
- Press
- Welding
- Lapping and Finishing
- Metallurgical
- Induction Heat Treating
- Hydrogen Copper Brazing





BURGESS-NORTON PLANT
at Geneva, Illinois

Burgess Norton

MFG. CO. GENEVA, ILLINOIS

For the Larger Tougher Jobs

The larger sizes of AMPCO Twist Drills have the strength and toughness that only the hammer-forging of the finest steel can produce. All AMPCO drills over ½" also have polished flutes. More and more tool buyers from coast to coast are discovering AMPCO these days. Result of over 30 years research, AMPCO offers the extra quality and performance that cuts production costs. If you're looking for "something better" in twist drills, try AMPCO.

"Be Sure *Buy* AMPCO"

AMPCO

A Division of

GREENFIELD TAP and DIE CORPORATION

Greenfield, Massachusetts

THE GEOMETRIC TOOL COMPANY

New Haven 15, Connecticut

A Division of Greenfield Tap and Die Corporation

The "BUSINESS" End of GTD AMPCO END MILLS

The BUSINESS end of an End Mill is what counts in both actual cutting and in cost of operation.

And it is good business to use "Greenfield-Ampco" End Mills. Made in a full range of types and sizes to traditionally high standards of quality, there is a "Greenfield-Ampco" End Mill for your every need.

As a matter of good business, buy End Mills with good "business ends."

"Be Sure *Buy* GTD-AMPCO"

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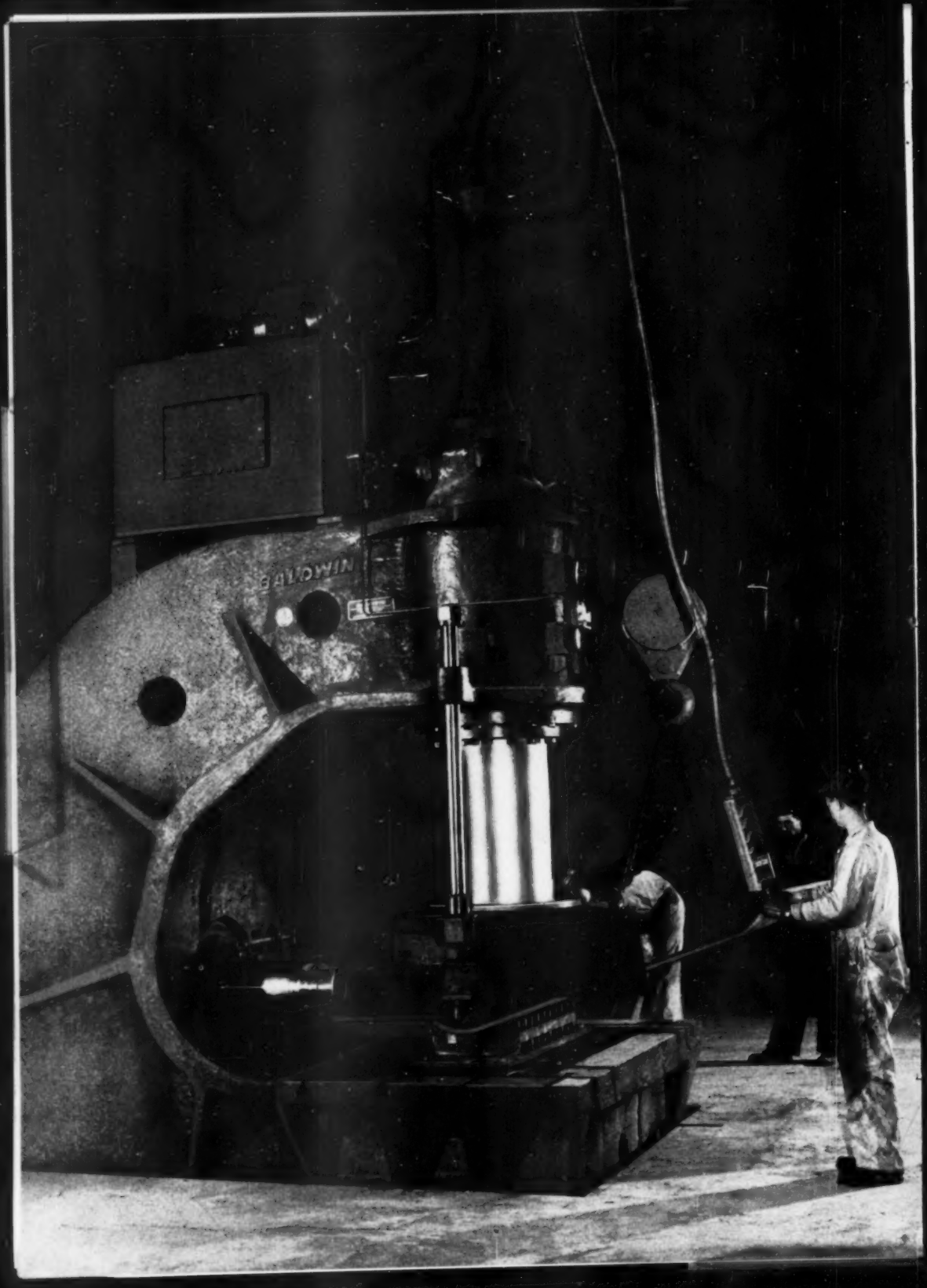

BALDWIN

BALDWIN PRESS AT NATIONAL TANK COMPANY

does *many* jobs *well*

Aiming at expansion of both the scale and the scope of its operations, National Tank Company of Tulsa, Oklahoma, recently installed a new Baldwin 400-ton gap type press.

If past experience is any guide, this press will quickly earn the blue ribbon as the most versatile, profitable and helpful piece of equipment in the shop. It handles crimping, flanging, straightening and joggling operations rapidly and precisely, helps to expedite the flow of orders through the shop, and produces at a rate that spells better profits for the owner.

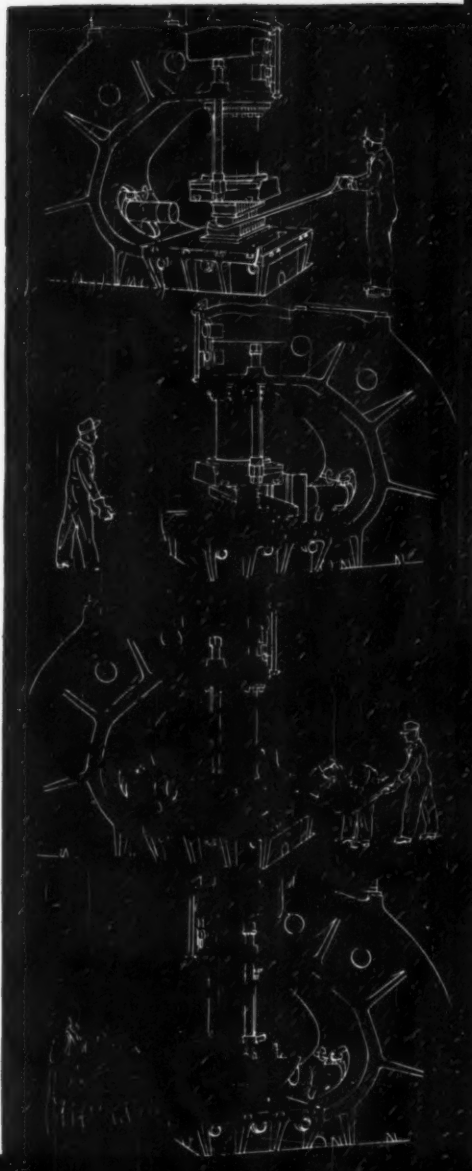
Baldwin's Hy-speed Hydraulic System adds a big plus to the performance of every Baldwin press. The speed of the ram in every portion of the stroke, as well as the length of "dwell," is under continuous and complete operator control. An important refinement is found in the packing, which automatically adjusts itself to the pressure to which cylinder and ram are subjected. Re-packing can be done from the outside, without any necessity for major dismantling. The safety of the operator is given top consideration, with automatic stoppage of the slide in case of power failure—complete auxiliary manual control even in the cases of semi-automatic or automatic operation . . . and instant stoppage in case of emergency, and return of ram to top position

Details are given in Bulletin 285, sent on request. A representative will be glad to consult with you, and work out the type of press best suited to your needs.

The Baldwin Locomotive Works, Philadelphia 42, Pa., U.S.A. Offices: Boston, Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington. In Canada: Baldwin Locomotive Works of Canada, Ltd., Toronto, Ontario.

BALDWIN

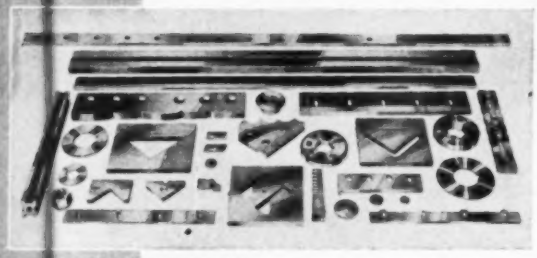
HYDRAULIC PRESSES



HILL ACME *TOOLS FOR INDUSTRY*

GRINDING and POLISHING MACHINE

"Hill" 2-Roll Vertical Abrasive Belt ***Hydraulic Table Type*** for flat polishing of ferrous or nonferrous sheets and other materials . . . also, made in ***Pinch Roll Type*** for surfacing Sheets, Strips or Plates, whereby a group or battery of machines may be placed in series for continuous polishing . . . likewise built in ***Strip Type*** for processing strip material in coiled form . . . furnished in a progression of widths up to 60".

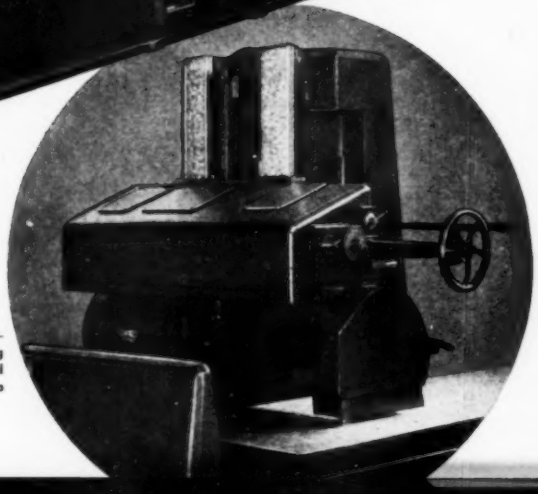


SHEAR KNIVES

"CLEVELAND" Knives and Shear Blades. Solid and laid steel shear blades; rotary slitting and side trimming knives; metal cutting machine knives.

VERTICAL GRINDER

"Hill" Open Side Vertical Spindle Hydraulic Surface Grinders are designed for rapid stock removal and accurate grinding of flat surfaces. Furnished in table widths of 18", 24" and 30"; table lengths 60" to 240".



HORIZONTAL GRINDER

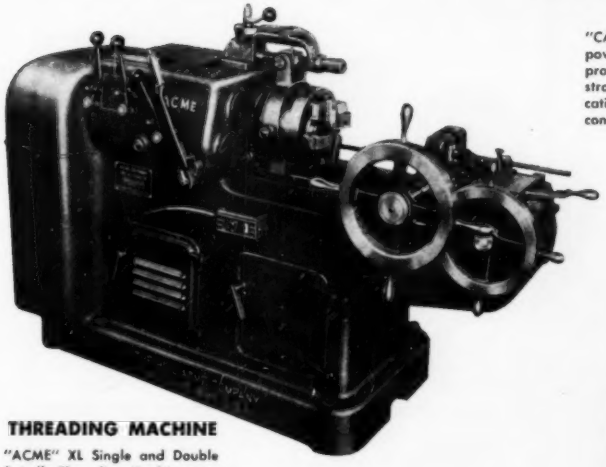
"Hill" Open Side Horizontal Spindle Hydraulic Surface Grinders for accurate grinding of flats, angles, irregular and special shaped surfaces. Furnished in table widths up to 36"; table lengths 60" to 240".

FLOOR CRANE

"CANTON" Portable Cranes are constructed of welded steel, with high tensile drop forgings; equipped with self-locking worm as safety feature. Made in 8 sizes from 1 to 3 ton capacity. Fast, safe, one-man operation.

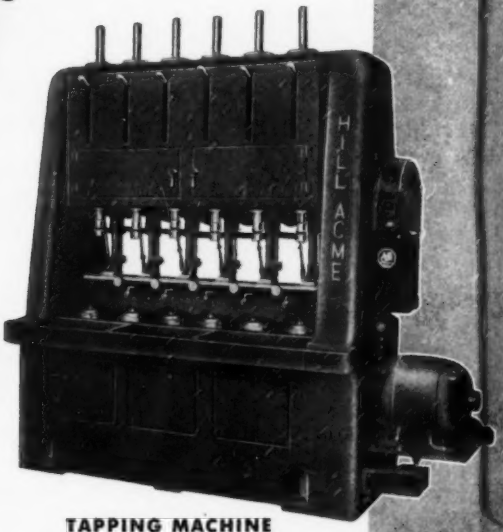
ALLIGATOR SHEAR

"CANTON" Alligator Shears are the most rugged, powerful and trouble free shears ever built for processing scrap. Modern design has produced a stronger shear, with fewer parts, and positive lubrication. Made in a full range of sizes to meet every condition.



THREADING MACHINE

"ACME" XL Single and Double Spindle Threading Machines are equipped with patented tangent or hob type die head which assures economical, accurate, high speed production. Furnished in sizes from 1" to 3" capacity.



TAPPING MACHINE

"ACME" model XC-W six spindle Coupling Tapper. Built in 1" capacity and larger, in 4, 6 or 8 spindle. Can be adapted as a nut tapper.

FORGING MACHINE

"ACME" XN Forging Machines produce accurate, quality forgings for long uninterrupted periods. Massive construction and simplicity of operation insure years of trouble-free service. Built in 7 sizes from 1 to 5 inches.

HILL ACME TOOLS FOR INDUSTRY

The HILL ACME COMPANY

PLANTS AT 1201 W. 65 ST. AND 4533 ST. CLAIR AVE. Cleveland, Ohio

NEW!

SUNDSTRAND AUTOMATIC LATHES HAVE GREATER H. P. AND RIGIDITY FOR FASTER TURNING WITH MULTIPLE TOOLING

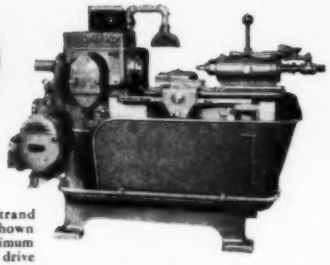
Comparison of Features Shows Greater Work Capacity and Flexibility For Handling *BOTH* Short and Long Run Turning Jobs

● You'll do more work with these new Sundstrand Automatic Lathes. You'll have ample power for carbide tooling plus improvements for quicker set ups. Make a comparison of these new machines with older models.

Greater Horse Power

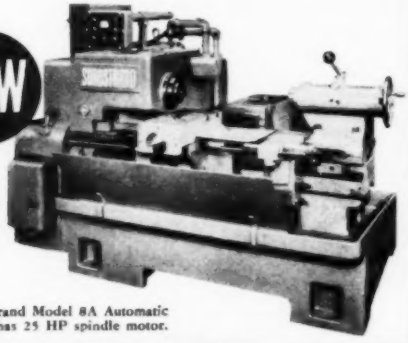
All new Model Sundstrand Automatic Lathes have been re-designed for greater rigidity and larger motors. The new Model 8A is equipped with a spindle drive motor up to 25 HP, as compared to 10 HP on the old Model 8. The new Model 12A has up to 50 HP drive against 20 HP for the old Model 12. Note the massive headstock design in the machines illustrated.

OLD



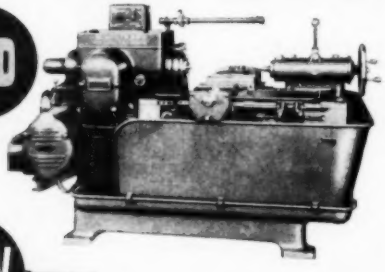
Model 8 Sundstrand Automatic Lathe shown above with maximum of 10 HP spindle drive motor.

NEW



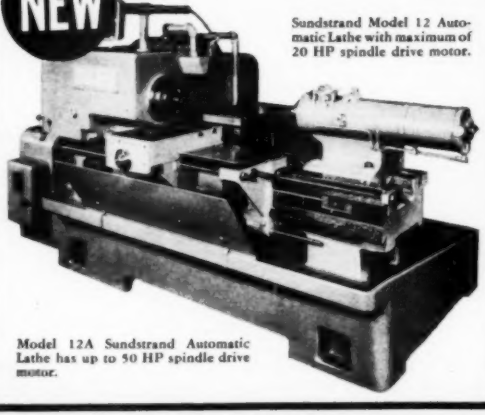
Sundstrand Model 8A Automatic Lathe has 25 HP spindle motor.

OLD



NEW

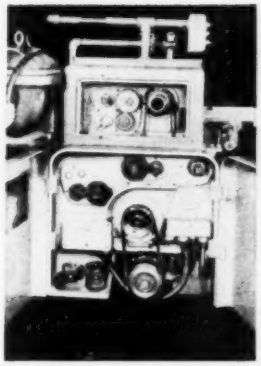
Sundstrand Model 12 Automatic Lathe with maximum of 20 HP spindle drive motor.



Model 12A Sundstrand Automatic Lathe has up to 50 HP spindle drive motor.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT



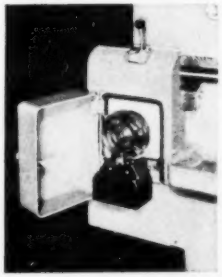
Faster Set-Up

The photo at the left is an end view of machine showing convenient location of pick-off gears for changing spindle speeds and front and rear carriage feeds. The feed and speed chart and pick-off gear storage compartment are all readily accessible for quick set-up or changeover.

Wider Speed Range

Spindle speed range ratios have been increased from 10 to1 on the old models to 30 to 1 on the new Model 8A and 12A to obtain maximum in cutting efficiency over a wider range of sizes of parts and material. The spindle unit is equipped with two driving gear centers, which increase the range between high and low spindle speeds. In addition, four speed changes can be obtained from one set of gears instead of the usual two.

Quick Cycle Change-Over



Complete control of all cycles is provided by adjustment of dogs on a disk as shown in illustration. Making cams is eliminated. Changing position of dogs on disk changes length of rapid approach, feed and rapid return strokes — enables operator to set up cycle quickly and changeover from one job to another easily.

Wider Feed Range

A wider feed range has been provided to enable the handling of a greater range of parts and materials at maximum cutting efficiency. For instance, the old Model 8 and 12 Lathes have a feed ratio of 13 to 1. The new Models 8A and 12A have a ratio of 18 to 1 between high and low feeds.

Automatic De-Clutching

All new Sundstrand models have been provided with automatic de-clutching between spindle and spindle motor with self-adjusting magnetic clutch and brake for quick stopping of spindle rotation.

Greater Carriage Adjustment

Another new feature of modern Sundstrand Automatic Lathes, both front and rear carriage are adjustable full length between headstock and tailstock centers.

Screw Feed to Front Carriage

All new Sundstrand Automatic Lathes have screw instead of rack feed to the front carriage — resulting in fine finish and long tool life.

Automatic Lubrication

To insure long machine life and lower maintenance costs, all moving parts within the machine, such as, spindle bearings, gears, carriage and cross slide ways, are provided with automatic lubrication.

Hardened and Ground Carriage Ways

All new model Sundstrand Automatic Lathes have hardened and ground carriage and cross slide ways.

Greater Chip Capacity

Ample provision in base for chip removal and coolant collection is provided in all new models.

FREE Additional Data

The Complete new line of Sundstrand Automatic Lathes includes the Models 4, 8A, 12A and 16 and they range from 5 to 75 HP. Write for complete information on these new machines today. Ask for Bulletins 189.

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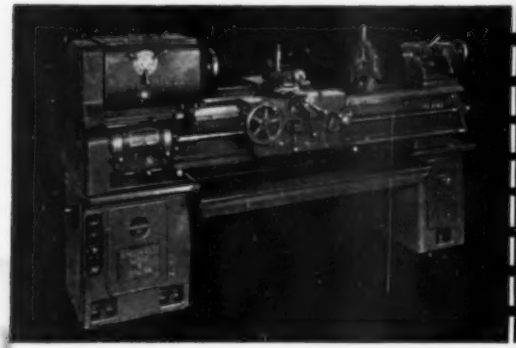
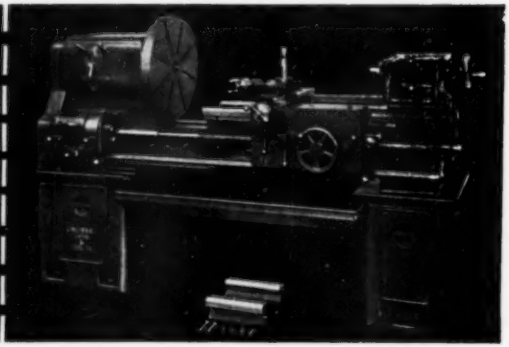
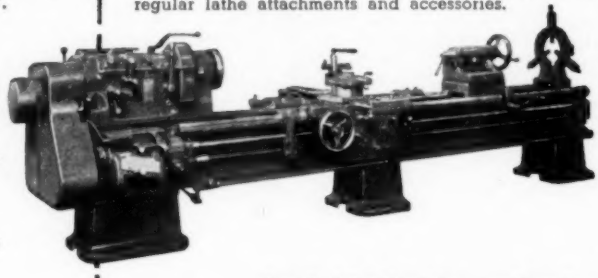


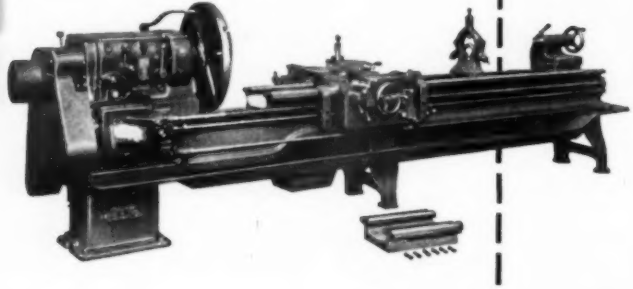


Lightweight Champ: The new Tray-Top line of light duty geared head engine lathes (10", 12½", 15", and 18" swing sizes) offers many "high price" lathe features at truly low cost: 12 spindle speeds, selected by color-coded dial; 48 thread and feed changes; exceptionally large spindles; anti-friction bearings, double-walled apron; totally enclosed quick change gear box; many others. Distance between centers from 18" to 60".

All This – And Gap, Too: 15" and 18" Tray-Tops furnished with gap, give you 22" and 25" swings over gap. Carriage has short wings on headstock end for maximum approach of tool; wings on tailstock are extended for maximum rigidity and adequate bearing surface on bed. Like regular Tray-Top, distance between centers from 18" to 60", in increments of 6". All furnished with regular lathe attachments and accessories.



Middleweight Champ: In the medium duty class, the Standard line (14", 16", 18" 20", 22", and 24" nominal swings) assures you real all-around utility with exceptionally low initial investment; quickly pays for itself by efficient handling of practically all your turning, boring, and threading operations. 12 spindle speeds; 32 thread and feed changes; distance between centers from 30" to 240".



Gaps In All 6 Sizes – Increase Capacity: With swings over gap from 24½" to 38½", Standard Fixed Gap Bed Cintilathes give you oversize work capacity where cost of heavy lathe is not justified. Versatility and economy are balanced to your requirements.

WRITE FOR BULLETINS: *T-100 on Tray-Tops; T-101 on Tray-Tops with Gap; S-100 on Standards; S-101 on Standards with Gap.*

the best buy in its class

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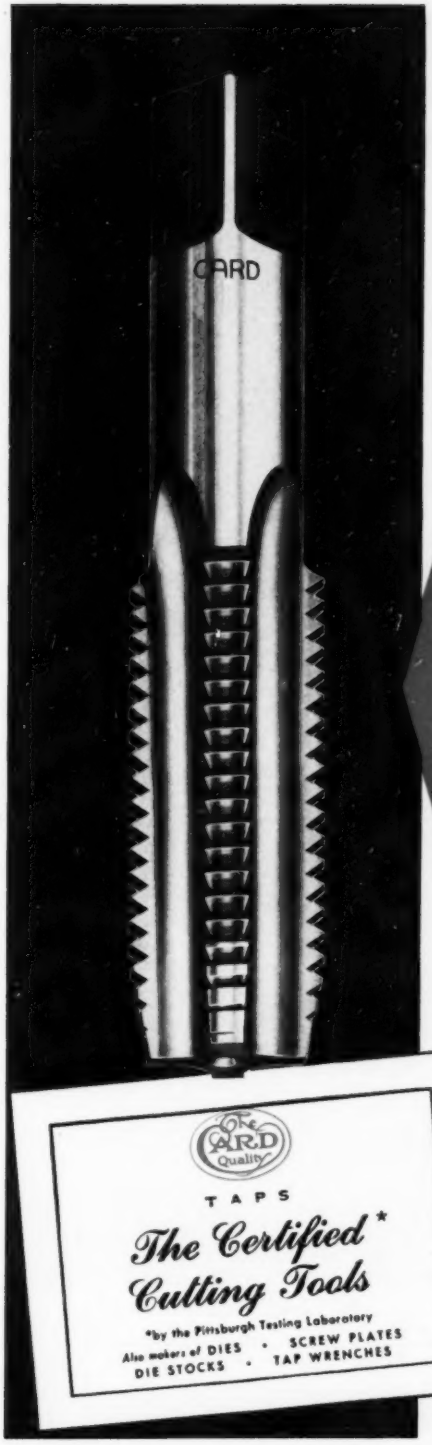
CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO



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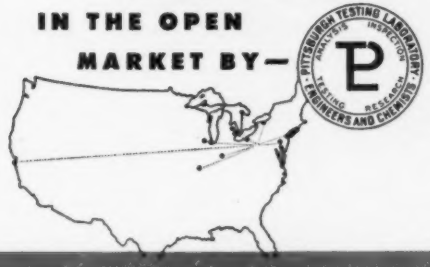

*Only Card Taps Are CERTIFIED**

Card's refusal to "take a chance" on quality is one big reason why metal workers rely so confidently on Card cutting tools.

Recognizing the need for a truly *objective* test of its products, Card retains the famous Pittsburgh Testing Laboratory to buy Card Taps periodically *anywhere it pleases on the open market* . . . put them through severe tests to make *absolutely certain* that they meet the highest standards. These taps are then CERTIFIED* as meeting proper specifications.

You'll find Card Certified* Taps and fast, dependable service at your nearby Card Distributor. Contact him for real savings in time and money.

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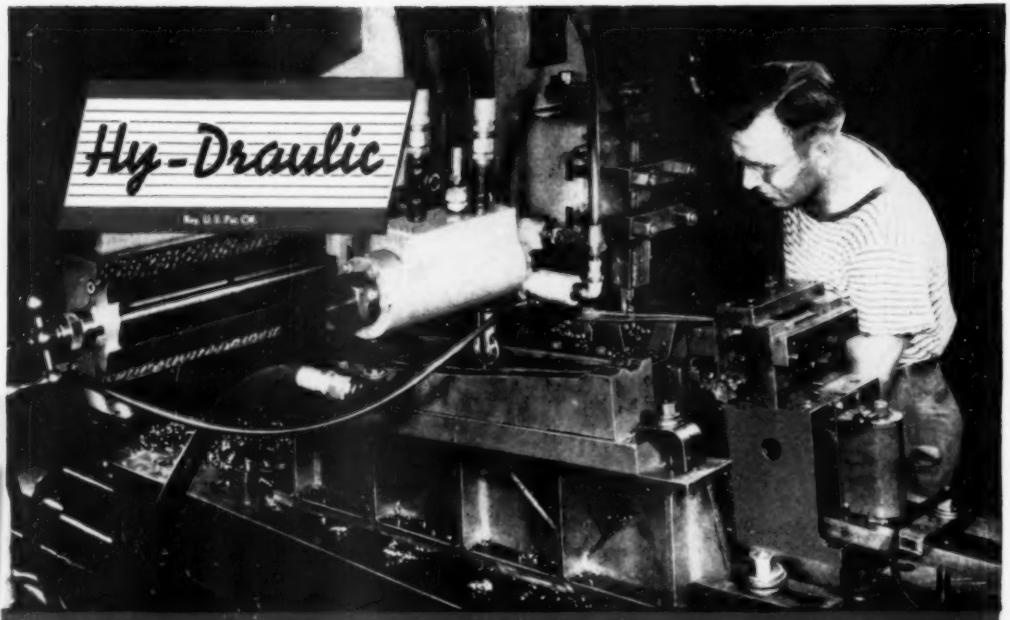
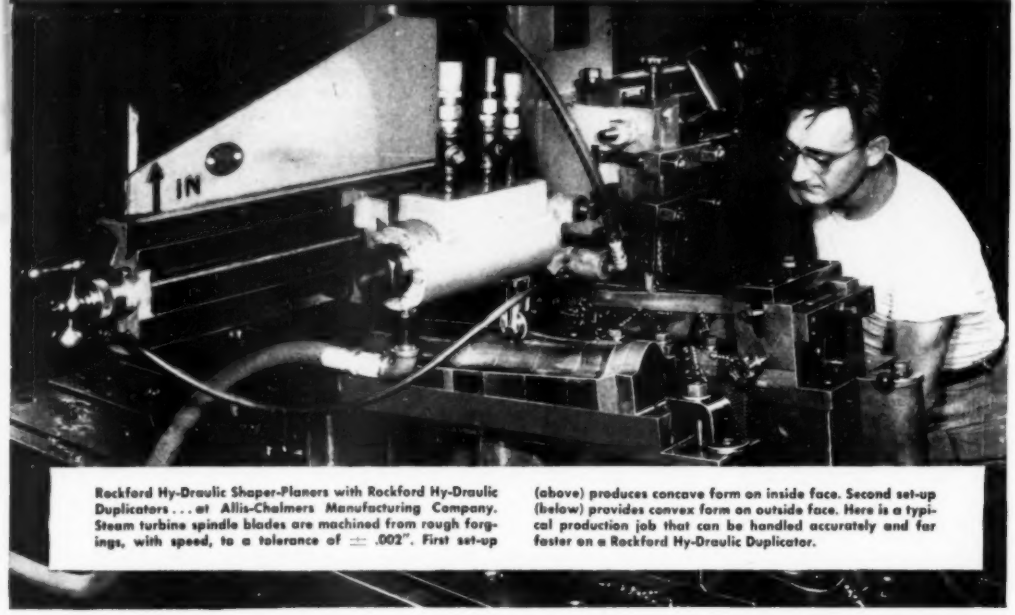


Here are the machines



Rockford Hy-Draulic Shaper-Planers with Rockford Hy-Draulic Duplicators . . . at Allis-Chalmers Manufacturing Company. Steam turbine spindle blades are machined from rough forgings, with speed, to a tolerance of ± .002". First set-up (above) produces concave form on inside face. Second set-up (below) provides convex form on outside face. Here is a typical production job that can be handled accurately and far faster on a Rockford Hy-Draulic Duplicator.

DURING RECENT MONTHS the tremendous economies made possible by the Rockford Hy-Draulic Duplicator have been proved over and over again. In die or mold making, even though a part may be made only once, the duplicator has proved itself practical by the time and money it saves. A pattern in plaster or other easily worked material can be used as the guide for machining the part.

In production work, the initial pattern can be made of wood or plaster . . . and be used to machine the template or form to be used in production machining.

While this method of machining may be well known as a theory, the Rockford Hy-Draulic Duplicator installed on Rockford Hy-Draulic machines has definitely made the method practical. Basically the reason is, that with Rockford equipment such work is machined as quickly as any type of shaper or planer work . . . with accuracy to the thousandth of an inch. The fact that the duplicating unit is hydraulic in design, means that movement established by the tracer or follower is directly imparted to the tool head. No secondary mechanical motions exist to reduce speed or cause inaccuracies.

CHECK THE FACTS . . . let a Rockford sales engineer give you complete information on Rockford Hy-Draulic 36" Openside Shapers, Planers, or Shaper-Planers equipped with Rockford Hy-Draulic Duplicating attachment.

and the facts

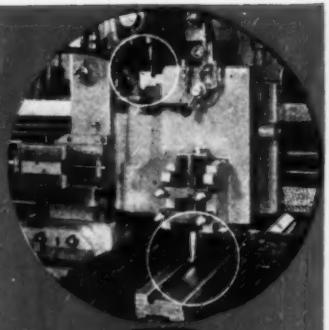
CHECK THESE ROCKFORD HY-DRAULIC DUPLICATOR ADVANTAGES:

- Hydraulically actuated . . . provides speed and accuracy. Built by Rockford Machine Tool Co. . . . builder of Hy-Draulic machine tools since 1929.
- Saves tremendous time and cost. One typical job on one part alone saved almost four days of hand scraping for two men.
- Stylus or tracer is in contact with master only on cutting stroke. On return stroke both tracer and tool are lifted. This saves wear on master, tracer, and tool . . . and permits use of carbide tools. In addition, return stroke can be set for fast speed . . . to save in overall machining time.
- Attaches to any size Rockford Hy-Draulic 36" Openside Shaper, Planer, or Shaper-Planer.
- Duplicator operates at any cutting speed . . . the same speed you would use in machining without the duplicator attached.
- Stylus or tracer pressure is extremely light.
- Automatic tool lift and head lock if power fails.
- Tool head hydraulically counter-balanced.
- Feed movement of duplicator may be set to operate at either end of stroke which is advantageous on some duplicating work.

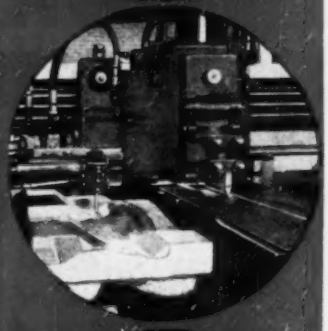
Write for complete information to:

ROCKFORD MACHINE TOOL CO.
2533 Kishwaukee Street • Rockford, Illinois

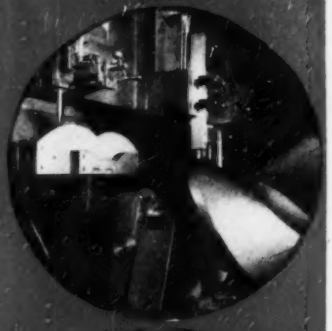
FOUR TYPICAL JOBS AND FOUR TYPES OF SET-UP



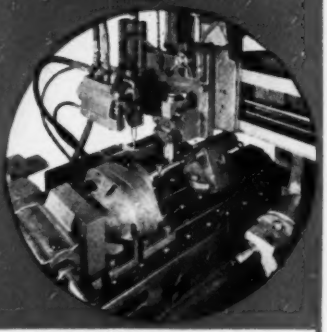
work with the same cross section along the line of machining . . . with stationary template mounted on rail.



work with form changing constantly along line of machining . . . with traveling template mounted on planer table.



work where tool travels at fixed level during cutting stroke with helix generated by table fixture . . . stationary template mounted on rail.



work where tool travels over changing level during cutting stroke with helix generated by table fixture . . . traveling template mounted on planer table.

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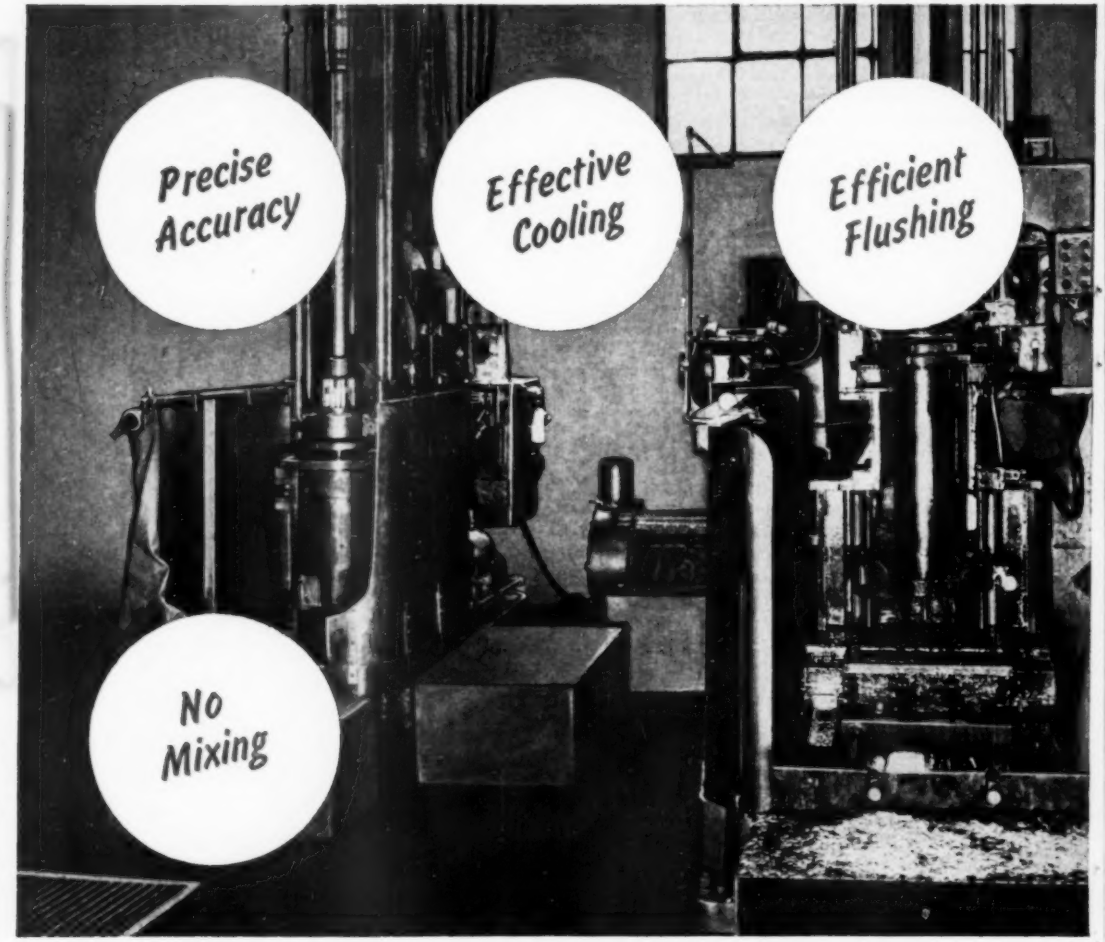

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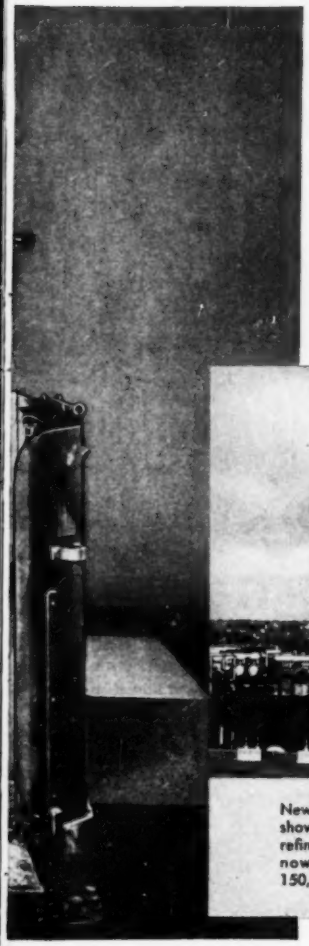
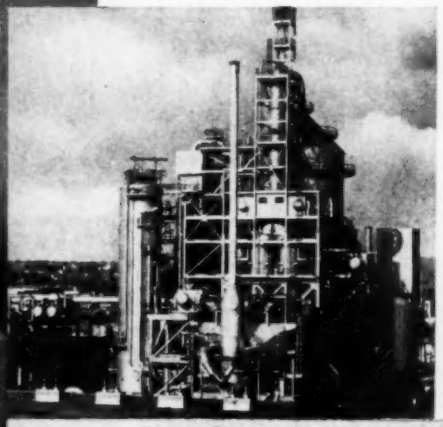
YOUR NEAREST SUPPLIER OF SINCLAIR PRODUCTS WILL GLADLY ARRANGE

Cools and Flushes Precision Finish



Coolant properties and flushing action are important characteristics in a good honing fluid . . . for generated heat must be carried away steadily to prevent distortion and provide precision and accuracy in the final dimensions. In addition, fine abrasive particles from the honing stones must be flushed away so that the finish will be clean and unmarred.

Sinclair HONOL meets all the rigid working requirements of both the operation and the metal. This fluid comes in suitable grades ready for use. For precise accuracy and for fineness of finish, use HONOL.



New Fluid Catalytic Cracking Stills (like the one shown here) are helping to expand Sinclair's refinery output. Sinclair's great refineries are now turning out products at the rate of 150,000,000 gallons of lubricating oil yearly.

About 40% of all the Aircraft Engine Oil used by domestic Airlines in the U.S.A. is supplied by SINCLAIR. The same careful research that developed this high quality oil for the Airlines is put into HONOL and other Sinclair Oils.

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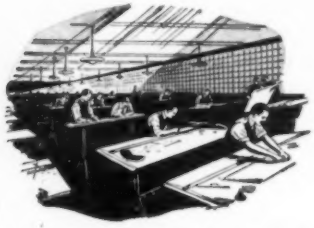
FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.

A note on Abrasives

Improved Abrasive Tools help step up production...cut costs

New production efficiencies and economies are being realized almost daily as a direct result of technical advances in abrasive products. At The Carborundum Company these improvements do not just "happen." They are derived from a carefully formulated program. Product Development...an important activity here...pools specialized knowledge, experience and skill. It probes into the performance of present products...seeks and finds possibilities for doing the job better. It examines and compares the action of bonded and coated products under every conceivable production condition. It studies and restudies technical advances in machines and methods. CARBORUNDUM'S development staff turns up ideas that can be incorporated into new products as well as better ways of using present products. Both are important to production management. As a user of abrasive products by CARBORUNDUM, you receive the direct benefit of all advances in product development. This —together with abrasive engineering and other services—offers another reason for specifying and buying abrasive tools produced by CARBORUNDUM ...the leading name in abrasives. The Carborundum Company, Niagara Falls, New York.



The only complete line of Abrasive Tools is

CARBORUNDUM

TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Engineering News
ON ABRASIVE PRODUCTS

Belt Backstand Idler Techniques Effect Operating Cost Reduction

Substantially increased output, lower unit costs and improved finishes are influencing more metal working plants to switch to belt backstand idlers for grinding and finishing flat and contoured surfaces of both small and medium weight pieces. In many factories where set-up wheels were formerly used, conversion from 25 to 100% to the backstand technique has been effected. While these methods normally involve grinding speeds of 6500 to 7000 SFPM with glue-bonded abrasive cloth belts, speeds of 10,000 SFPM are being used widely today with resin bonded belts.

As a result of recent wide-spread experiences with belt backstand idler techniques, our trained staff of engineers is equipped to guide users in making the best use of this equipment. In all cases they are able to recommend applications and abrasive materials to meet your requirements.

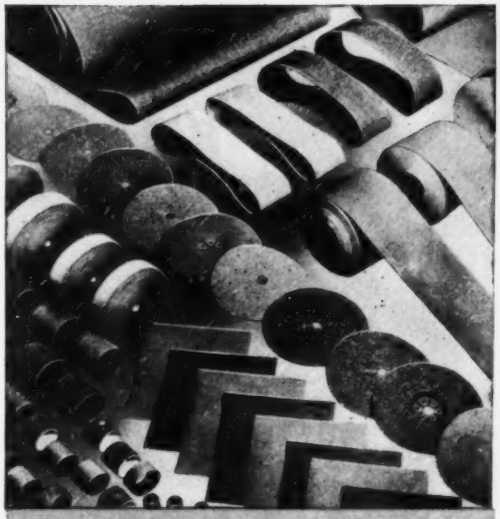
Better Work with Cylindrical and Crankshaft Grinding

Cylindrical grinding wheels including crankshaft wheels by CARBORUNDUM are engineered to provide the tools required for maintenance of efficient production rates, rapid stock removal and fine surface finish.

V11 bond represents the most recent contribution to this class of grinding. These wheels are designed with a *specific structural balance* which when combined with the proper grain size and abrasive type offers the following advantages to both operator and management:

1. Cool and free cutting characteristics promote more efficient production of superior finishes and close tolerances. This is of great importance in operations involving both OD and shoulder or face grinding.
2. Designed structural balance permits continuous fast cutting rates which promote high production.
3. Fast cutting qualities combined with long life save dollars in operator and machine time as well as abrasive costs.
4. Engineered uniformity of the abrasive and bond components of these wheels permits close control of part size and form.
5. Self dressing characteristics provide longer periods of use between dressings... save dressing time, usable abrasive and dressing tools.
6. Ability to grind a wide range of materials makes possible savings in inventories of special wheels and minimizes requirements for premium priced abrasives.
7. Savings in set-up time are made possible because the versatility of V11 bond wheels permits efficient grinding of many varieties of work, making it unnecessary to change wheels when changing from one job to another.

For prompt attention to abrasive problems, call your nearest branch office of The Carborundum Company.



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BONDED PRODUCTS — ABRASIVE WHEELS • STICKS, STONES AND RUBS • SPECIALTIES • SUPERFINISHING STONES • SPECIAL FORMS • ABRASIVE GRAINS AND FINISHING COMPOUNDS

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THAT "Something Extra" YOU GET IN CONTINENTAL CUTTING TOOLS

CONTINENTAL'S engineering knowledge is an important extra you get in Continental cutting tools. Continental's 30 years' experience as designer and manufacturer of a wide range of cutting tools is your assurance of correct design, exactness of manufacture, and greater accuracy and production in operation. Continental products include counterbores, face milling cutters, broaches, and special carbide-tipped tools. Continental can help you raise your production and reduce your unit costs. Call your local representative, or write Ex-Cell-O in Detroit today!

CONTINENTAL TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

WANT TO

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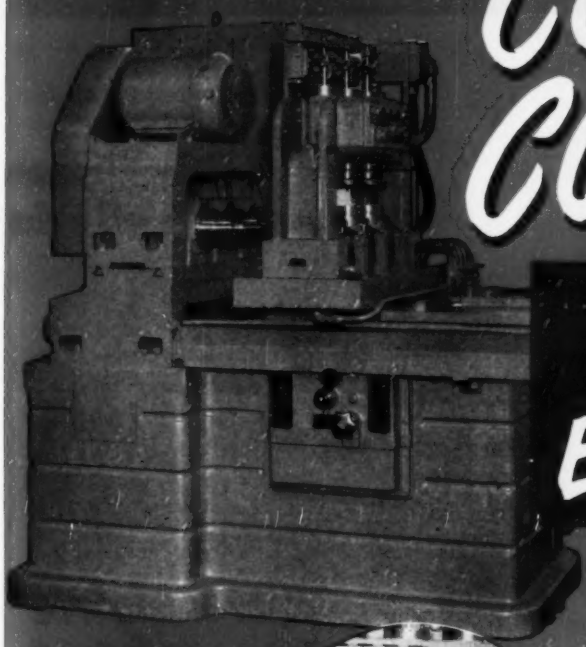

SEE

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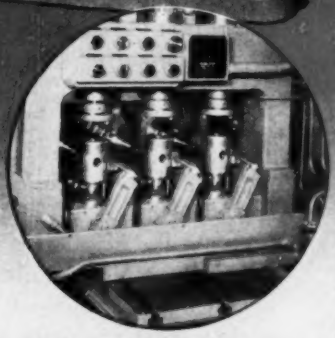
For Example:

Ex-Cell-O Standard Machine with High Production Fixture—Bores Piston Wrist Pin Holes with .0003" Tolerance at Net Rate of 211 Pieces per Hour!



To right: Picture on Ex-Cell-O 112-C Precision Boring Machine provides hydraulic locating and clamping. Operation is tied in with machine cycle. The addition of two interchangeable sets of lower work centers and locating pins adapts the fixture for the whole group of pistons.

The Precision Boring Machine shown to left above (Ex-Cell-O Style 112-C) bores piston wrist pin holes at a rate of 211 pieces per hour, holding a tolerance of .0003" on the bore diameter, and providing a fine surface finish. The high production fixture accommodates a wide variety of similar pistons. Ex-Cell-O machines like this are also widely used for precision turning, facing and grooving operations. If your production involves parts like this, call your local Ex-Cell-O representative, or write Ex-Cell-O in Detroit today!

EX-CELL-O

CORPORATION

49-9

XLO — EX-CELL-O for PRECISION

DETROIT 32, MICHIGAN

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

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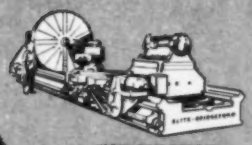
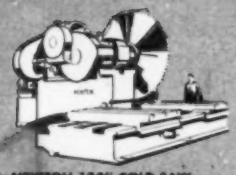
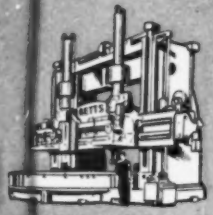


BETTS-BRIDGEFORD 96" LATHE

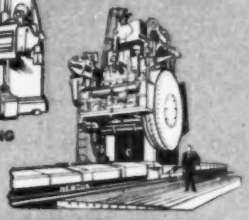


NEWTON 120" COLD SAW

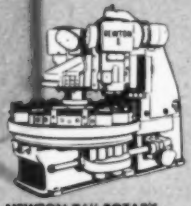
BETTS-BRIDGEFORD RAILROAD AXLE LATHE



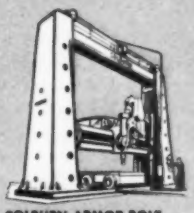
BETTS VERTICAL BORING AND TURNING MILL



NEWTON 120" COMBINATION PLANER AND SAW

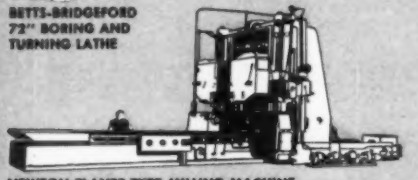


NEWTON 76" ROTARY CONTINUOUS MILLING MACHINE



COLBURN ARMOR BOLT DRILLING AND THREADING MACHINE

BETTS-BRIDGEFORD 72" BORING AND TURNING LATHE



NEWTON PLANER TYPE MILLING MACHINE

Serving the metal continuously for

The Consolidated Machine Tool Corporation, oldest continuous builder of heavy duty machine tools, is proud of its record of more than one hundred years of service to the metal working industry, together with the reputation established over that period for high grade, dependable machines.

As the name implies, the Consolidated Machine Tool Corporation is a consolidation of seven well-known, old line companies . . . Betts Machine Tool Works, Bridgeford Machine Tool Works, Colburn Machine Tool Works, Hilles & Jones Company, Modern Tool Works, Newton Machine Tool Works and William Sellers & Company, each a recognized leader in the production of its own particular type of machines. Collectively, they offer, under the Consolidated name, one of the world's most complete lines of heavy duty machine tools backed by wide experience for which there is no substitute.

Today, Consolidated Machine Tools are in service in all parts of the globe . . . in prac-

CONSOLIDATED MACHINE TOOL CO

I D A T E D

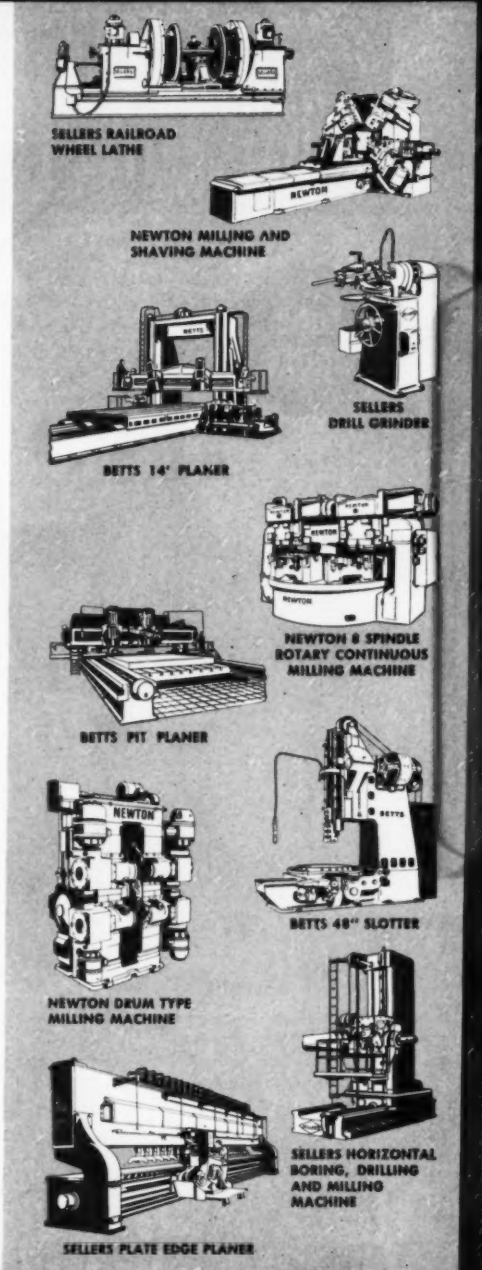
HILLES & JONES • MODERN • NEWTON • SELLERS

working industry over a century

tically every type of metal working plant including mass production shops, automotive, tractor and aircraft plants, railroad locomotive and car shops, shipyards, steel mills and general industry. That they provide long, satisfaction-giving service is evidenced by many of the early-built machines that are still in service.

To meet modern industry's demand for faster, lower cost production, Consolidated Heavy Duty Machine Tools are painstakingly designed to provide the greater speed and economy of operation required. This advanced Consolidated engineering successfully combines high efficiency with lasting accuracy and long productive life with a minimum of maintenance cost.

As your production problems arise requiring either standard or special heavy duty machine tools, we will welcome your inquiries. Our many years of specialized, varied experience in this work is at your service.



SELLERS RAILROAD WHEEL LATHE

NEWTON MILLING AND SHAVING MACHINE

SELLERS DRILL GRINDER

BETTS 14' PLANER

NEWTON 8 SPINDLE ROTARY CONTINUOUS MILLING MACHINE

BETTS PIT PLANER

BETTS 48" SLOTTER

NEWTON DRUM TYPE MILLING MACHINE

SELLERS HORIZONTAL BORING, DRILLING AND MILLING MACHINE

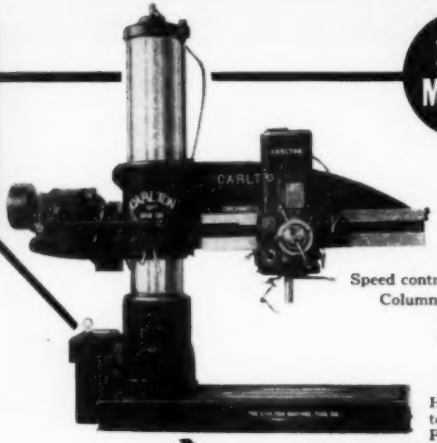
SELLERS PLATE EDGE PLANER

RPORATION-ROCHESTER, NEW YORK

CASH IN ON CARLTON PROGRESS

Comparison of CARLTON RADIAL DRILLS

1929 MODEL



Soft spindle.
Ball Bearings.
Speed control levers on back of Arm.
Column clamp mounted on Base.
Gears, shafts and spindle machined from bar stock.

1949 MODEL

Hand operated clamping to Head and Arm.
Power clamping to Column.
Lever operated Arm elevating controls.
Hand lubrication to Column.
4 levers to control 48 spindle speeds through speed box mounted on arm.
Spindle speed reference chart.
Friction feed clutch.

Mechanical Advantages

Ground teeth, hardened gears with wider faces.
Hardened spindle.
Ball and roller bearings.
All speeds in Head controlled by two levers.
Column clamp mounted in Arm.
All parts, wherever possible, are machined from drop and hammered forgings.

Heavier Arm, Base and Column for greater rigidity in 1949 models. Independent motor driven operating units are built into machine, mounted in fully enclosed cabinets, and easily accessible to the operator and maintenance man.

Maintenance Advantages

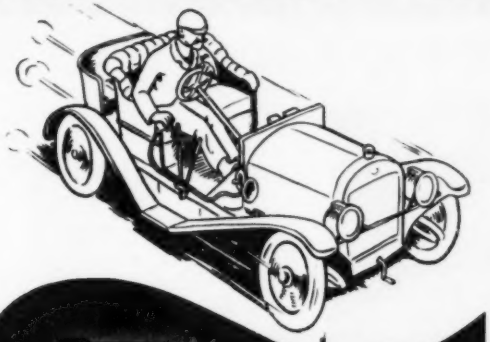
Every part is jig machined to absolute interchangeability of parts.
Entire machine is assembled on the unit principle.
Only one friction clutch unit to adjust.
Simple electric circuits to all motors.
Easier to keep clean.
Many other features. Write for bulletin.

Operation Advantages

Dual clamping to Head and Column. Automatic clamping for Arm to Column.
Pushbutton operated Arm elevating control.
Automatic lubrication to column with column cleaned by wipers from top to bottom.
2 levers to control 36 spindle speeds from Head.
Direct reading and indicating speed and feed chart.
Electric light built in Head near spindle.
Adjustable counterbalancing spring operating with standard geared-to-spindle counterweight.
Positive feed clutch with serrated teeth.

THE CARLTON MACHINE TOOL CO.
CINCINNATI 25, OHIO, U. S. A.

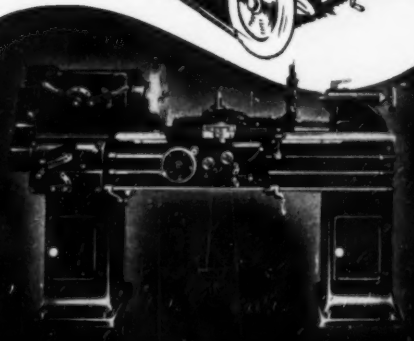
HOW MANY "MUSEUM PIECES" ARE YOU SUPPORTING?



● Remember back in the early '20's when the "Boss" came breezing down the street in a cloud of dust at a snappy 25 to 30 miles per hour. That was some car in its day and the "Boss" was proud of its accomplishments, its beauty and its riding comfort. Today it is a museum piece.

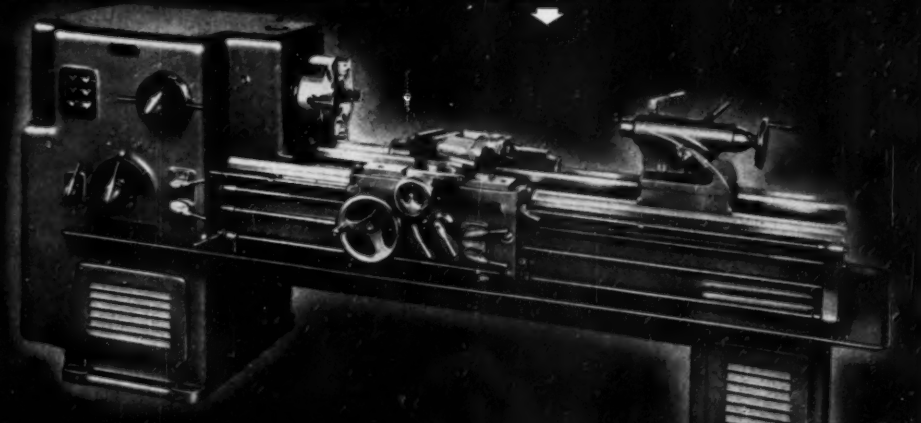
Are you using an old 8 speed Sidney 16" lathe similar to the 3 horsepower model shown? If you are still running one of these old relics you are actually supporting a "museum piece." These "old timers" cannot approach the low production costs available from the modern, powerful, high speed Sidney Lathes being offered today.

Look at them—compare the figures below—and you'll see that you cannot go wrong with any late model Sidney Lathe.



OLD MACHINE	
Swing	16 inches
Weight	3600 lbs.
No. of Spindle Speeds	8
Range	17 to 375 R.P.M.
Headstock	Spur Gear
Motor	3 H.P.

NEW MACHINE	
Swing	16 inches
Weight	7500 lbs.
No. of Spindle Speeds	32
Range	19 to 1500 R.P.M
Headstock	Herringbone
Motor	15 H.P.



SIDNEY MACHINE TOOL *Company*

BUILDERS OF PRECISION MACHINERY SINCE 1904 — SIDNEY, OHIO

American Machine & Metals

A big advantage of this 450-ton Lake Erie Hydraulic Press is its versatility and ability to perform a wide range of manufacturing functions. American Machine and Metals report that the press is already handling the following types of work and more are contemplated—

- **Plate forming of mild steels.**
- **Piercing washer trunnion spiders.**
- **Multiple riveting of spiders to heads.**
- **Deep drawing of shell doors, dump valves and door latch housings.**
- **Stamping stainless steel washer parts.**
- **Blanking fan blades and discs.**
- **Forming stainless steel cylinder heads.**

Many manufacturers are taking advantage of the greater flexibility and efficiency of modern hydraulic presses. They are replacing outmoded, inefficient, costly methods of production with the latest Lake Erie Hydraulic Presses.

cuts Production Costs with
LAKE ERIE Hydraulic Press

Eliminates patterns... machine work and expensive castings

A good example of the way in which modern hydraulic presses make it possible to improve product quality and decrease manufacturing costs is provided by American Machine and Metals, Inc., of East Moline, Illinois. Formerly, the pedestals and shell for the Atlas Laundry Extractor, manufactured for their Troy Laundry Machinery Division, were made of cast iron. Now they are formed out of sheet steel. American Machine and Metals point out the following advantages for this type of construction:

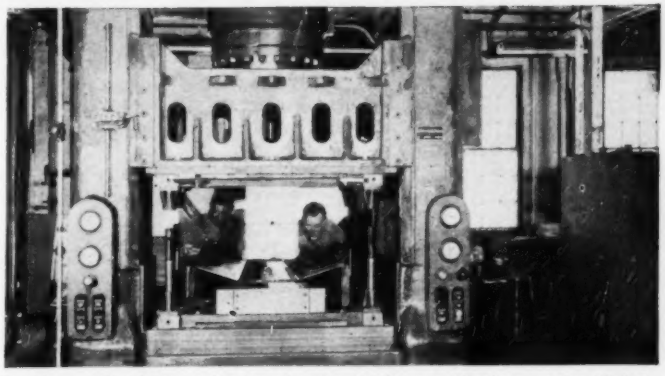
FLEXIBILITY
of machine proper, eliminating rigidness, strain and resultant breakage.

STRENGTH
allowing use of lighter material for less over-all weight of given part.

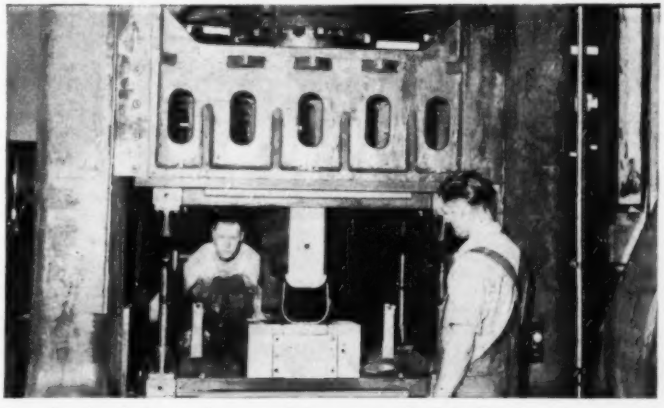
TIME SAVING
Hydraulic press does job in one operation.

COST SAVING
eliminates patterns, machine work, welding, expensive castings, complicated fabrication, cuts labor costs.

Lake Erie Hydraulic Presses have made it possible to improve product quality and decrease manufacturing costs in hundreds of plants. It will pay you to study your production methods ... to determine if they can be performed better at less cost by modern Lake Erie Hydraulic Presses.



Locating a pedestal prior to forming. American Machine and Metals report that this Lake Erie Hydraulic Press can be set up quickly, is fast on production and has lowered manufacturing costs.



Formed pedestal about to be removed from press. The Lake Erie Press is extremely accurate, turns out uniformly high quality products and reduces rejects says American Machines and Metals.

●Leading manufacturer of hydraulic presses—all sizes and types—metal working ... plastics molding ... forging ... metal extrusion ... processing ... rubber vulcanizing ... stereotyping ... special purpose.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE ENGINEERING CORP.

MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY

★

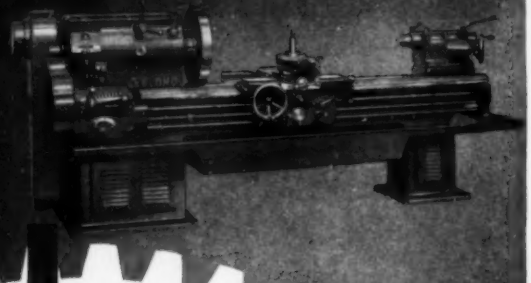
General Offices and Plant:

507 Woodward Ave., Buffalo 17, New York

DISTRICT OFFICES IN NEW YORK, CHICAGO AND DETROIT

Representatives in Other Principal Cities in the United States and Foreign Countries

PRODUCTION IS NO GAME FOR OLD LATHES



1939 ★ 1949

BACK IN 1939 when you bought your new LeBlond 16" heavy duty engine lathe the clouds of a world war were hanging over your head. During much of the time that followed, you probably used your LeBlond on two or three shifts daily, so that you can truthfully say it has been "through the wars". Maybe it's not as accurate as it used to be, because the war shortened the normal useful life of many a machine tool.

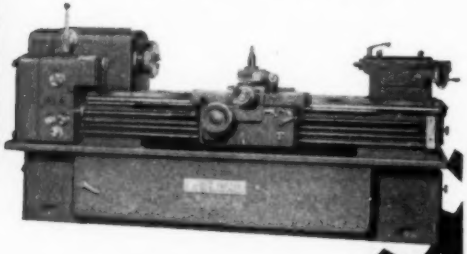
THE LATHES OF YESTERDAY should be written off—yes, even those good old LeBlond lathes—because today's conditions call for machine tools that can help produce more goods faster and at less cost. And the new 16" LeBlond Model RT heavy duty, the lathe of tomorrow, is ready for today's cost-cutting competition. Its combination gear-belt drive headstock gives you more speeds, faster speeds, all shifted with a single lever. It delivers more power to the spindle yet costs you less in power consumption per horsepower.

YOUR OPERATORS can produce more on the Model RT because it's designed to save time and effort. For example, the single lever (on the apron) that controls the 4-directional power rapid traverse moves cutting tool in and out and also moves the carriage up and down the bed. On the old 16" you made these adjustments manually.

EVEN MAINTENANCE takes less of your operator's attention. The quick change box is totally enclosed, and lubrication to headstock, feed box and apron is entirely automatic.

YES, TEN YEARS make a big difference in a lathe. With the pressure on to reduce costs, you can't afford anything but the most modern and efficient machine tools. Send today for Bulletin HD-30-A for complete information on the Model RT.

16" LeBLOND HEAVY DUTY ENGINE		16" LeBLOND MODEL RT HEAVY DUTY
12	Spindle speeds, number	16
15 to 525 rpm	Spindle speeds, range	30 to 1537 rpm
Gear	Method of drive to spindle	Gear-belt
1 to 120	Range, threads	2 to 120
No.	Hardened and ground steel bed ways?	Yes
No.	Reverse to leadscrew?	Yes
No.	Totally enclosed, automatically lubricated quick change box?	Yes
No.	4-directional power rapid traverse?	Yes
7½-hp 1200 rpm	Motor recommended	15-hp 1800 rpm



THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

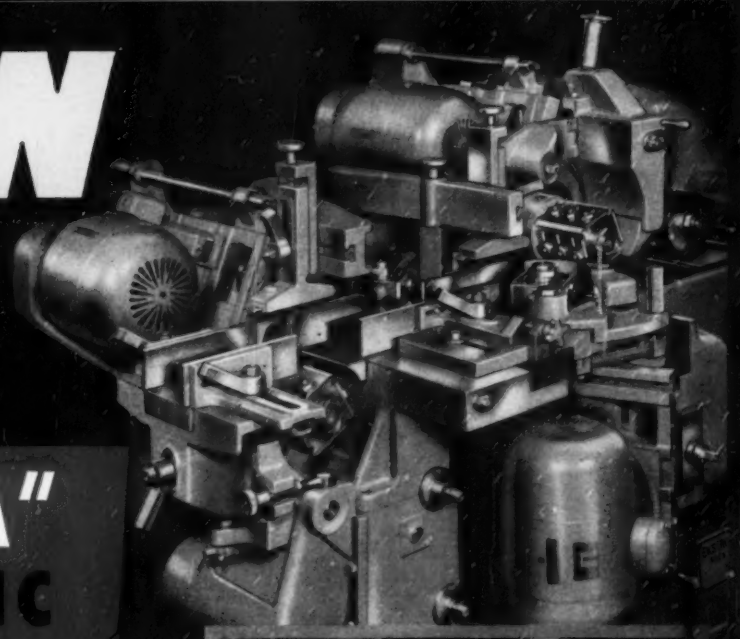
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

SALES OFFICES: NEW YORK, CHICAGO, DETROIT

LeBLOND

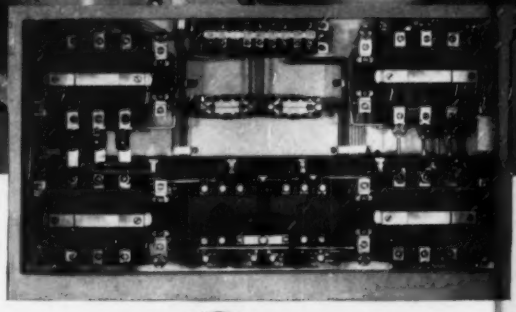
NEW

ARROW AH HART



TYPE "RA" MAGNETIC STARTERS

SIZE 2

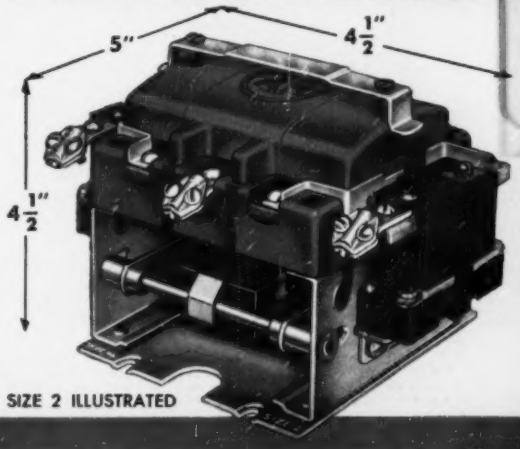


Versatile IN APPLICATION IN PERFORMANCE

The Ekstrom Carlson moulder features a special control panel designed and built by W. F. and John Barnes. This panel, only *14" x 22"*, contains four Arrow-Hart Size 2 magnetic starters and one Size 1 magnetic reversing starter, with a unique center line wiring plan. These design innovations were made possible by the use of Arrow-Hart's new "RA" line of motor starters that are only 1/2 the size of conventional starters. This compact panel has a capacity of *over 100 H.P.* of divided motor controls with room to spare.

NEW RIGHT ANGLE BALANCED MECHANISM SAVES SPACE, PERMITS UNUSUAL LAYOUTS

Arrow-Hart's new right angle balanced mechanism has a knee-action bellcrank fulcrum, which transfers the leverage from a vertical to a horizontal plane. This multiplies the leverage and increases contact pressure. Greater power, finer balance, versatility — in an ingeniously compact design that cuts conventional starter size in half — all of this is due to the amazing new right angle, fail safe, balanced mechanism developed by Arrow-Hart.



SIZE 2 ILLUSTRATED

CONTROLS and APPARATUS FOR *Outstanding* PERFORMANCE

ARROW AH HART

ARROW·HART

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
103 HAWTHORN ST., HARTFORD 6, CONN., U. S. A.

SMALLEST STARTER ON THE MARKET

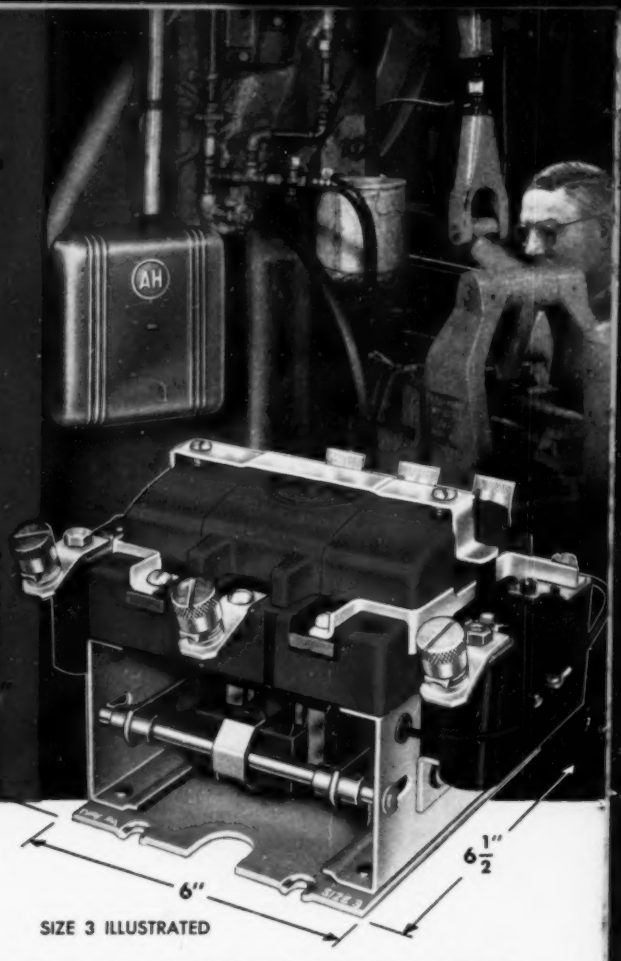
Features

BALANCED MECHANISM

Exclusive in

ARROW AH HART

SIZES 2 and 3 "RA" MAGNETIC STARTERS



SIZE 3 ILLUSTRATED

COMPACT—½ the size of conventional starters!

EASY TO WIRE AND SERVICE

Straight through wiring reduces bending and forming of heavy wires. Terminals are front wired. Line and load wires connect at opposite ends. **SAFE AND DEPENDABLE** High power at low wattage. Tough, dependable overload relay, with bimetallic inverse time element. Interchangeable heaters. **NEW, TOUGHER CONTACTS** A broad line-of-contact surface. Curved and movable against flat and stationary contacts. Tips of special silver alloy brazed to copper. **PLASKON ALKYD BASE AND HOOD** New tested Plaskon Alkyd molding compound used in protective base and hood. Exceeds arc resistance of next best material by 50% to 60%.

SIZE 2 MAX. H.P.

Volts	110	220	440	550
Single Phase	3	7½	10	10
Polyphase	7½	15	25	25

SIZE 3 MAX. H.P.

Volts	110	220	440	550
Single Phase	7½	15	25	25
Polyphase	15	30	50	50

WRITE TODAY FOR LITERATURE ON ARROW-HART TYPE "RA" MAGNETIC STARTERS AVAILABLE IN LOCAL AND REMOTE CONTROL OR SELECTOR SWITCH TYPES IN SIZES 0, 1, 2 and 3

Buy with Confidence
Profit by Performance

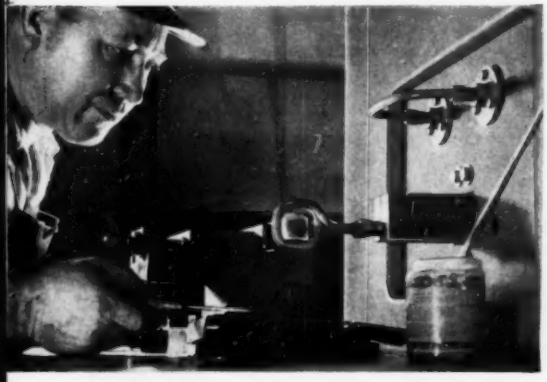
ARROW AH HART

THE ARROW-HART & HEGEMAN ELECTRIC CO.
103 HAWTHORN ST.
HARTFORD 6, CONN.

Induction Heaters Are Ideal For Job Lots

PRODUCTION RATES RAISED as much as 500% when this 20-kw unit took over the processing of 11 parts (from driving pinions to trimmer blades) at a southern machinery company. Only a switch of work coils is needed to change jobs. Hardening, brazing and annealing are all done on the one machine. Takes only a minute to switch from job to job.

NO SKILL NEEDED to operate the Allis-Chalmers induction heater on this annealing job according to the midwest manufacturer now using the unit. The same heater is also used for brazing fittings onto cases — with only a change of work coils. Annealing of cases takes nine seconds. Brazing two fittings at a time takes 15 seconds.



15 SECONDS is all it takes this big user of cutting tools to braze tungsten carbide tips to tool bits. A relatively unskilled operator does the job well. And it takes him less than a minute to change the work coil to handle a different size tool. The simplicity of Allis-Chalmers induction heaters makes them ideal for job or production work.

NO SPECIAL TRAINING needed to change work coils — no additional output transformers or capacitors needed. Allis-Chalmers induction heater is ideal for either production or job work. Unit shown does hardening, brazing, annealing, and soldering of small runs and individual pieces. No special work-handling equipment is required.

GET EXPERT ENGINEERING HELP! Allis-Chalmers engineers and methods experts will completely process samples of your work . . . suggest and design simple, effective work handling equipment, and quote per piece production and equipment costs. Standard ratings: 1, 2, 10, 20, 50, 75, 100, and 200 kw.

Check with your nearby Allis-Chalmers representative regarding this offer — or write direct.

ALLIS-CHALMERS

A-2827

ALLIS-CHALMERS, 999A SO. 70 ST.
MILWAUKEE, WIS.

Please send descriptive bulletin 15B6431A.

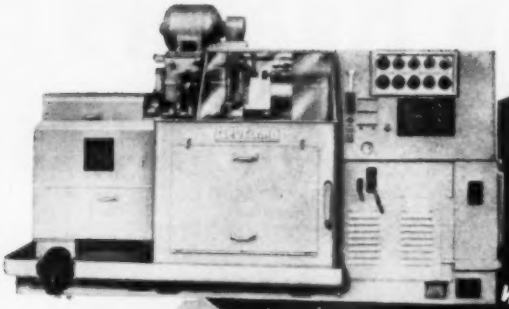
Name.....

Title.....

Company.....

Address.....

City..... State.....



all kinds of parts . . . from a variety of materials . . . fast, accurate, at low cost

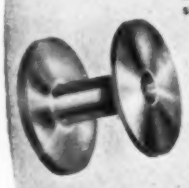
with the new DIALMATIC CLEVELAND

Model AB 2½" Single Spindle Automatic

ADJUSTING SCREW Close tolerances. From SAE 5120 hot rolled steel.

ALUMINUM CAMERA PART Exceptionally good finish and close tolerances held.

GEAR BLANK High production part from SAE 1050 cold rolled steel.



SPOOL Formed from free machining brass.

REDUCING BUSHING From SAE 1112 cold rolled steel. Commercial thread tolerances closely held.

SHOULDER BEARING From free machining brass. Fine finish important.

DIE CASTING INSERT Requires exceptionally good finish. From SAE 1112 cold rolled steel.

SHOWN here are a few samples of *profitable* production being turned out by prominent, cost-conscious manufacturers on new Dialmatic Clevelands.

The Model AB Dialmatic Cleveland is fast and accurate, rigid and powerful. Just consider this: Here, in one machine having a 2½" bar capacity, is a spindle speed range that permits you to thread 2½" diam. alloy steel down as low as 16 sfm—or work ⅞" free machining brass at 416 sfm! 112 spindle speed selections are available.

And set-up time is *short! Electric Feed Drive* operates all five turret tools (a 6-hole turret is supplied when required). Forward and return turret tool feeds are simply set by positioning dials on the control panel. Double cross slides operate by standard cams mounted on adjustable drums.

More versatile than any other automatic, the Model AB Cleveland is quickly and easily *converted to a chucker*—ideal for shops having an occasional chucking job to run in addition to their bar work.

Why don't *you* find out *now* if the new Dialmatic Cleveland can cut the cost of your production? Ask Camco engineers to submit a direct proposal with production estimates on your work. For complete machine specifications, write for bulletins.

The Cleveland Automatic Machine Co. manufactures and stocks a complete line of STANDARD TOOLING and COLLETS for use with Cleveland Automatics. Prompt deliveries. Write for complete information.

Remember, *Clevelands Cut Costs—*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati 12, Ohio

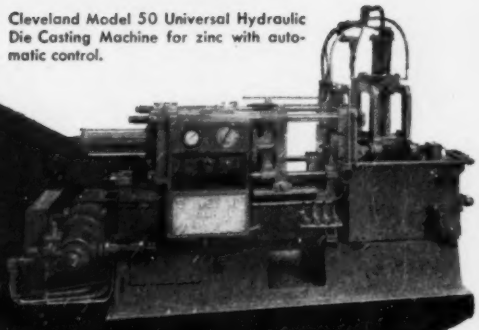
SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • NEWARK

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

CLEVELAND
presents with Pride

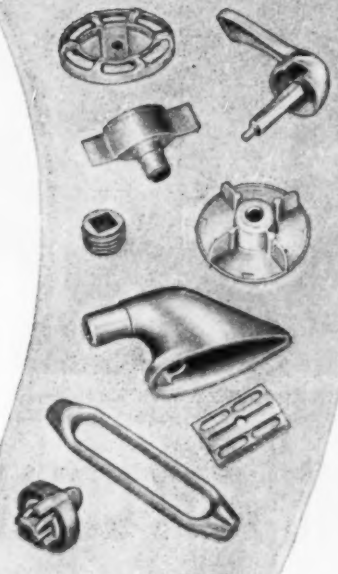
The New,

SMALL SIZE, LOW COST
Model 50 DIE CASTING MACHINE!



Cleveland Model 50 Universal Hydraulic Die Casting Machine for zinc with automatic control.

Get Fast Production on Zinc and Aluminum Parts like these with the new MODEL 50 CLEVELAND



Here is great news in die casting! Cleveland now makes available to *all* industry a rugged, small size, high production die casting machine that is priced *surprisingly low!*

Cleveland's time-proved leadership in die casting machine design has created in the new Model 50 a *fast . . . flexible . . . accessible . . . dependable* machine. It will produce dense, hardware finish castings at a very rapid rate.

Ease, convenience and safety of operation have been stressed in the Model 50 design. Construction is similar in many details to the widely used, large Model 400 Cleveland. The bed, tie bars, toggles, links, pins, platens, etc., are of heavy, rigid construction. Plenty of die handling space has been provided. A tote pan can be inserted in the bed to receive automatically ejected small parts. Either manual or automatic-timed controls can be supplied. The Model 50 converts from zinc to aluminum casting by simply changing hot metal ends.

Let a Cleveland Sales Engineer show you how this new Cleveland development can increase your production with *money saved!* A few Model 50 specifications are listed below. Write now for *complete* information.

Die Plates	22" x 18"	Die space	4" to 15"
Tie Bar diam.	2"	Die opening	8"
Locking pressure	50 tons	Floor space	52" x 116"

Weight of Zinc per shot—up to 4 lbs.
Weight of Aluminum per shot—up to 2.57 lbs.

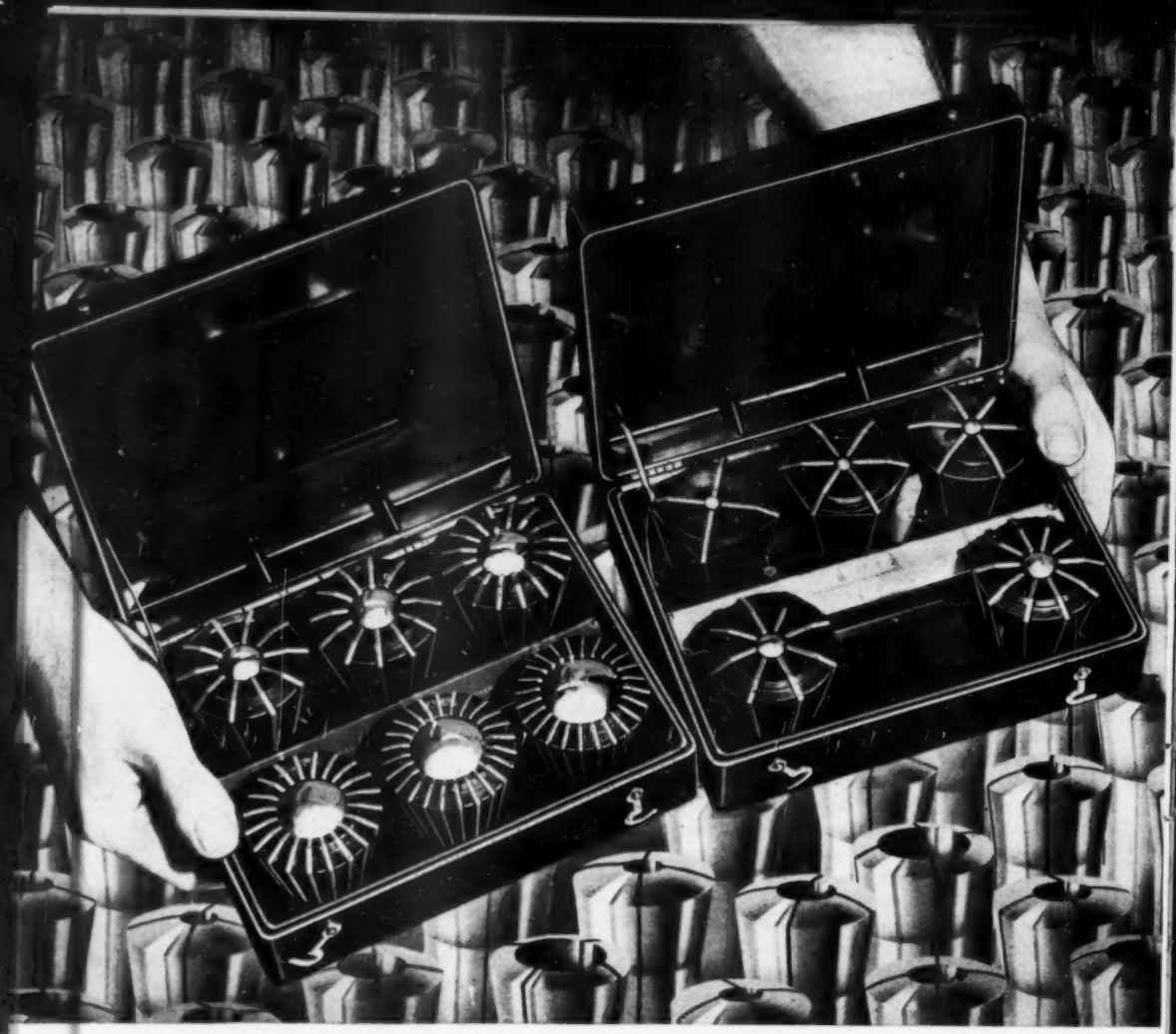
FREE CYCLE TIME
1000+Shots Per Hour!
Actual production rate dependent upon casting size and complexity.

Remember, *Clevelands Cut Costs—*

REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND MOST FOREIGN COUNTRIES.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines



SO FEW DO SO MUCH! The full set of eleven Jacobs Rubber-Flex Collets fits into two moisture-proof plastic boxes, each only 6 x 9 x 3"! They chuck any bar from 1/16" to 1 3/8". You'd need 88 steel collets to cover the same range in 64ths.

THESE 11 COLLETS DO THE WORK OF 88

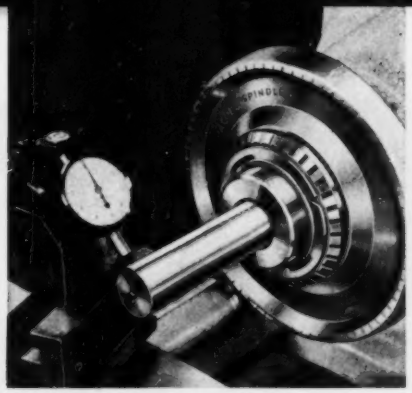
Revolutionary new collet design brings you unique performance

Each of these remarkable Jacobs Collets has a capacity of 1/8"...with accuracy and gripping power constant throughout! No more need to stock up on collets by 1/16", 1/32", 1/64", and special decimal and metric sizes. No more costly storing, maintenance.

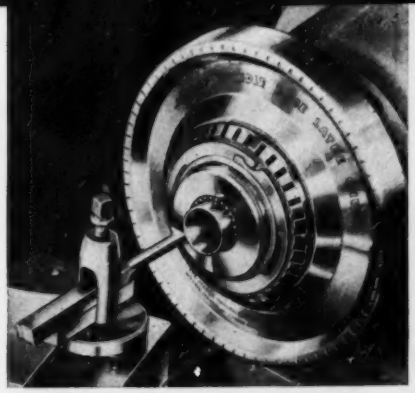
The hardened and ground steel jaws of the collets are bonded and mechanically locked together with Hycar Synthetic Rubber which will not set and which is not affected by heat, coolants, and cutting compounds. The jaws, being always parallel to the work, develop a gripping power of two to four times that of steel collets.

This chuck not only gives excellent performance when machining heavy cuts, but is equally outstanding when gripping thin shelled and fragile work.

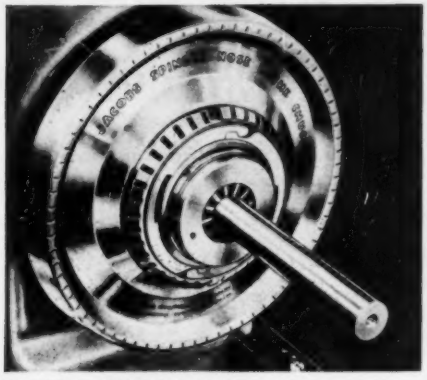
Write for bulletin 49-LC describing this new Lathe Collet Chuck.



UNPARALLELED ACCURACY — The most accurate Lathe Collet Chuck in the world today. The body is made from a single steel forging and is hardened and ground throughout. All internal and external surfaces of the collets are precision ground.



TWO TO FOUR TIMES THE GRIPPING POWER of split steel collets — *by actual test* — is yours with Jacobs Rubber-Flex Collets. Will not mar outer surface of the work as the gripping pressure is uniform over the entire length of bearing surface.



RUGGED CONSTRUCTION — With the exception of the solid aluminum Handwheel, all parts of the chuck are of hardened and ground alloy tool steel. Its compact design allows a saving of 1½" of overhang compared to present collet equipment. A unique impact tightening mechanism allows for very easy opening and closing of this chuck, thus reducing operator fatigue.

THE JACOBS RUBBER-FLEX COLLET

1. All external and internal surfaces precision ground.

2. The jaws in all collets have extremely long bearing surfaces in relation to the diameter.

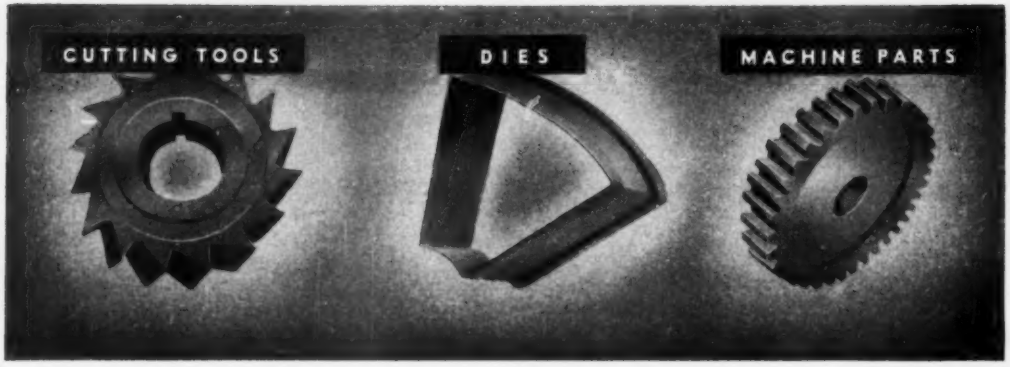
3. Collet jaw bearing surfaces always parallel to and in full contact with work, assuring accuracy and gripping power.

FOREMOST IN CHUCKS · FIRMEST IN GRIP

The *Jacobs* SPINDLE NOSE LATHE CHUCK

THE JACOBS MANUFACTURING COMPANY, West Hartford 10, Connecticut

If it's a JACOBS . . . it holds!



THEY DO THEIR WORK BETTER WITH THE HELP OF

NORTON® abrasives *oilstone files*

Here are the right tools to touch up a milling cutter, smooth off the burrs on a gear or fit a die—and *what a difference it makes in their performance!*

INDIA® and HARD ARKANSAS Oilstone Files, shaped to conform to work contours, and *all* file instead of rows of individual teeth, are the choice for this work among tool makers, die makers and master machinists. INDIA files of hard, sharp, electric-furnace aluminum oxide, are standard for general use. HARD ARKANSAS — a natural abrasive — is right for the finest jobs or the "finishing touches."

There are over two hundred different standard sizes and shapes of INDIA and HARD ARKANSAS Oilstone Files. Select the ones you need from the OILSTONE FILE BULLETIN. Write for it today.

BEHR-MANNING®

BEHR-MANNING

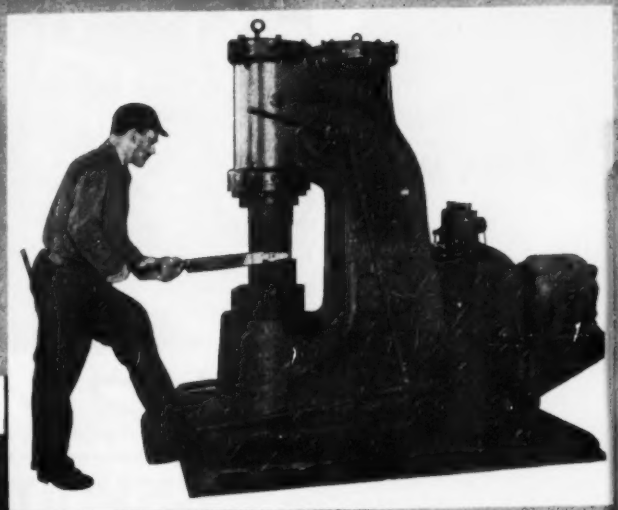
TROY, N.Y.

ALSO MANUFACTURERS OF COATED ABRASIVES

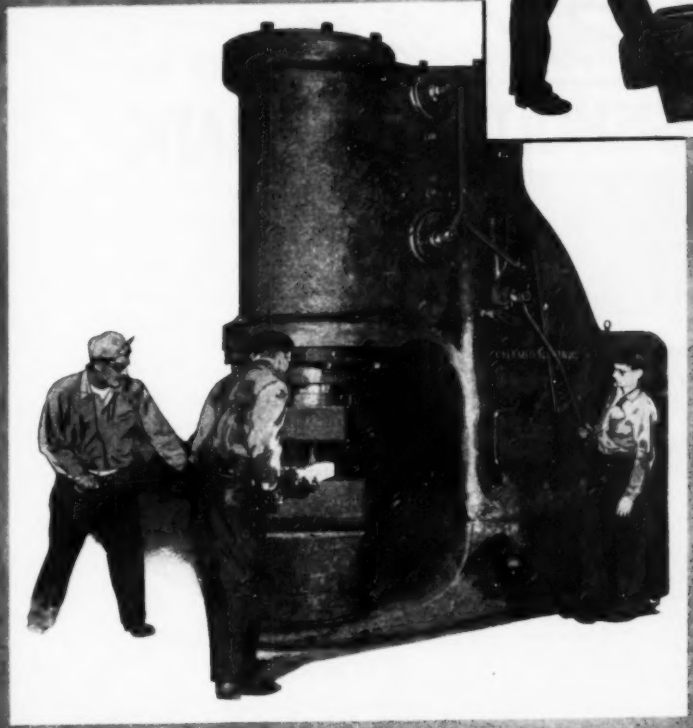
HAMMER-BUILDERS SINCE 1897...

CHAMBERSBURG

PNEUMATIC FORGING HAMMERS

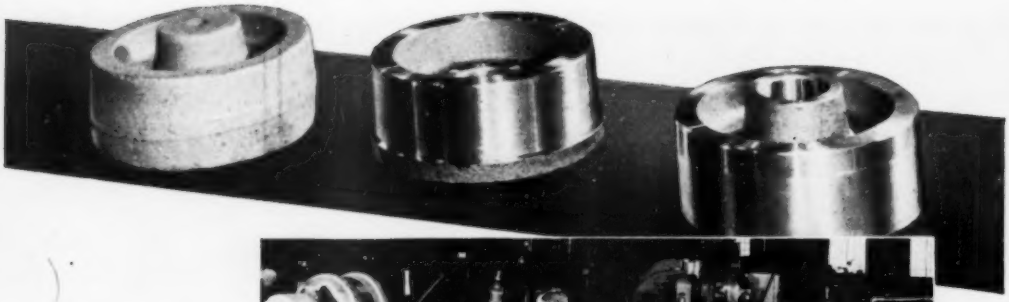


Typical installation of 200 lb. Hammer.



2000 lb. Pneumatic Forging Hammer in Prominent Steel Plant

Offer more forging output per hour, at lower cost per piece, than any similar hammer available. Completely self contained -hammer, motor and compressor - in sizes from 200 lbs. to 5000 lbs. Write for Bulletin



from 41.9 Minutes down to 15 Minutes

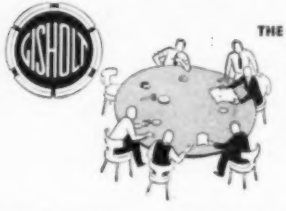
That's Productivity with the GISHOLT FASTERMATIC

The Gisholt Fastermatics are built in three sizes ranging from 21" to 36½" swing over bed.

The cost of machining these gear blanks at the Falk Corp. took a sharp drop when the Fastermatics took over. Time was cut nearly two-thirds. Moreover, human errors were eliminated, thanks to Fastermatic's ability to hold close tolerances.

One operator tends 2 Fastermatics and a honing machine. Simple tooling makes it possible to handle 9 different sizes of gear blanks.

These modern automatic turret lathes enable you to handle a larger number of operations in one chucking—and cut costs to the bone on a wide variety of work. Ask for facts about them.

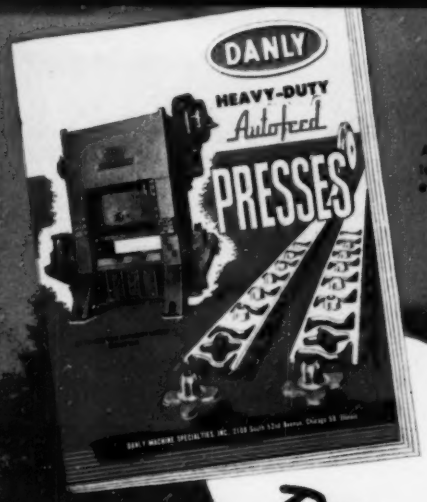


THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



A new 16 page booklet to tell you about real press engineering achievements.

HERE'S REAL PRODUCTION NEWS!

SEE WHY IT COSTS LESS TO RUN A DANLY PRESS!

This new booklet has been especially prepared to introduce the unique production advantages of the Danly Heavy Duty Autofeed Press . . . advantages that are certain to reduce stamping costs in your plant! Read about the new design principles that enable the Danly cool-running clutch to outwear conventional press clutches 7 to 1!

Check such outstanding advantages as extra frame rigidity, greater resistance to vibration and deflection at high speeds and consequent increased die life. Others include complete pressure lubrication, variable speed drive and more sensitive control reaction. Higher operating efficiency is assured over a greatly expanded tonnage range.

Also included are complete specifications on Danly Heavy Duty Autofeed Presses from 50 to 800 tons. Send for this booklet and see how Danly Autofeed Presses offer the advantages of automatic feeding in high tonnage capacities.

Detailed descriptions and illustrations explain the cost and performance advantages of exclusive Danly features.

SEND FOR YOUR FREE COPY TODAY . . . .

USE THIS COUPON

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue, Chicago 50, Illinois

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue, Chicago 50, Illinois

Please send my copy of the new Danly Heavy Duty Autofeed Press Catalog.

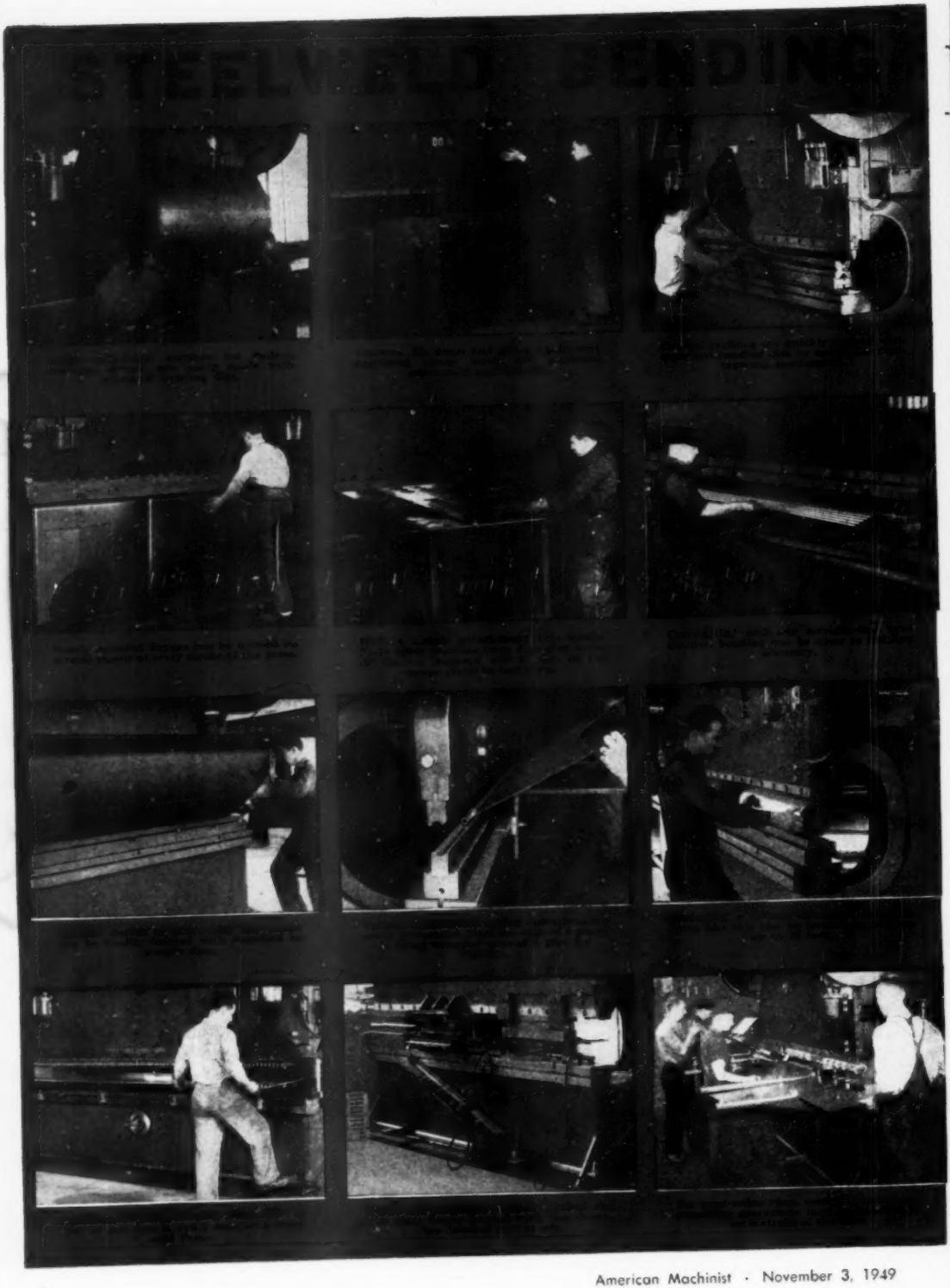
NAME

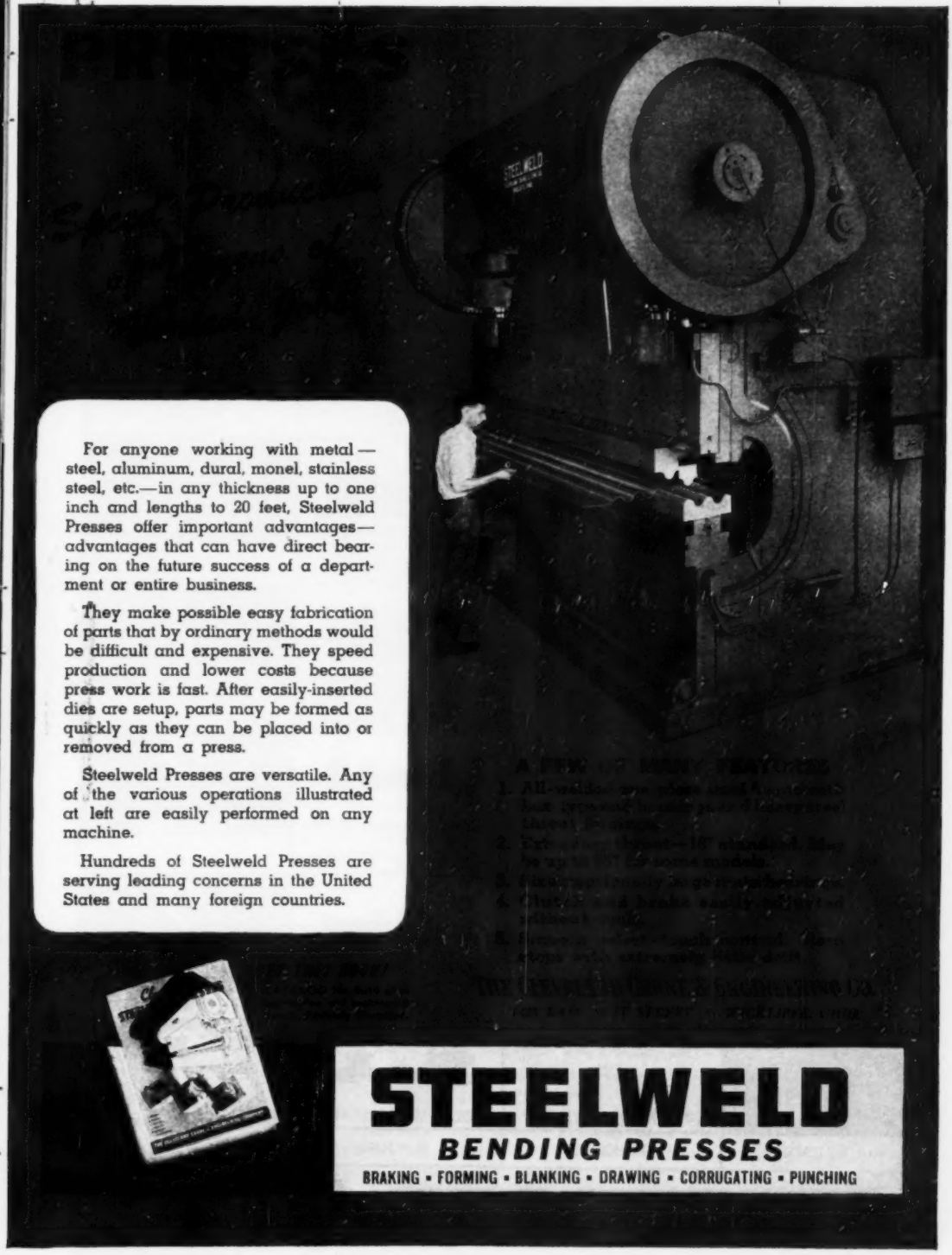
POSITION

COMPANY

STREET ADDRESS

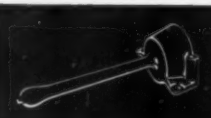
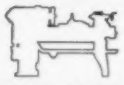
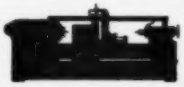
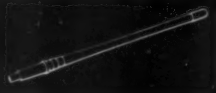
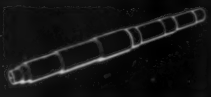
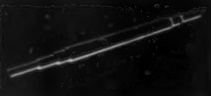
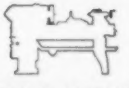
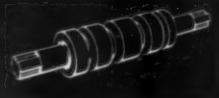
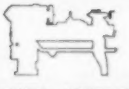
CITY ZONE STATE




STEELWELD
For anyone working with metal — steel, aluminum, dural, monel, stainless steel, etc.—in any thickness up to one inch and lengths to 20 feet, Steelweld Presses offer important advantages—advantages that can have direct bearing on the future success of a department or entire business.
They make possible easy fabrication of parts that by ordinary methods would be difficult and expensive. They speed production and lower costs because press work is fast. After easily-inserted dies are setup, parts may be formed as quickly as they can be placed into or removed from a press.
Steelweld Presses are versatile. Any of the various operations illustrated at left are easily performed on any machine.
Hundreds of Steelweld Presses are serving leading concerns in the United States and many foreign countries.
STEELWELD
BENDING PRESSES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

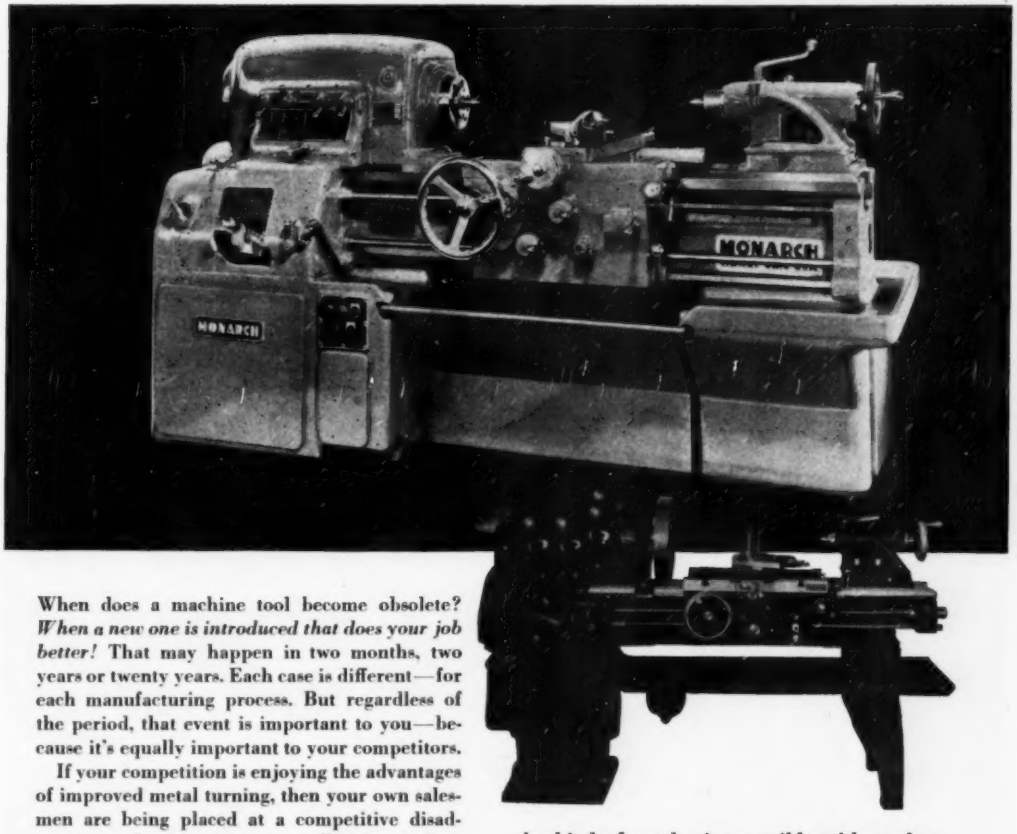
HERE'S HOW TO MAKE MORE *Money and* PARTS

CHECK YOUR PRODUCTION PERFORMANCES HERE

	FORMER METHOD	MODERN MONARCH METHOD	YOUR TIME
			?
AIRCRAFT ENGINE MOUNT	47 MINUTES	20 MINUTES	
			?
REAR AXLE SHAFT	4½ MINUTES	53 SECONDS	
			?
SHAFT	27 MINUTES	6 MINUTES 26 SECONDS	
			?
DRIVE SHAFT	23 MINUTES 23 SECONDS	7 MINUTES 41 SECONDS	
			?
GLASS DISH MOLD	200 HOURS	11 HOURS	
			?
BAR MILL ROLL	96 HOURS	10 HOURS	

FOR A GOOD TURN *FASTER* — TURN TO MONARCH

MONARCH'S MODERN METHODS MAKE THE DIFFERENCE



When does a machine tool become obsolete? *When a new one is introduced that does your job better!* That may happen in two months, two years or twenty years. Each case is different—for each manufacturing process. But regardless of the period, that event is important to you—because it's equally important to your competitors.

If your competition is enjoying the advantages of improved metal turning, then your own salesmen are being placed at a competitive disadvantage unless you, too, are selling a product produced by these same or *better* metal turning methods. Otherwise, your men will be selling a product that carries higher unit costs—or a product that cannot be delivered as soon, due to slower production.

These become your number one problem in a buyer's market—whether you have any direct connection with sales or not. (Without sales your production soon will be non-existent, anyway.) And these are important reasons why it will pay you to check your production records against the kind of production possible with modern Monarchs.

If you haven't heard directly, *in recent months,* the remarkable new performance records our customers are making with Monarch's latest lathes, on exactly your type of metal turning jobs, call your nearest Monarch representative—or write us, direct, for literature and performance data.

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

THE MONARCH MACHINE TOOL CO. Sidney, Ohio

THE *American* WAY...

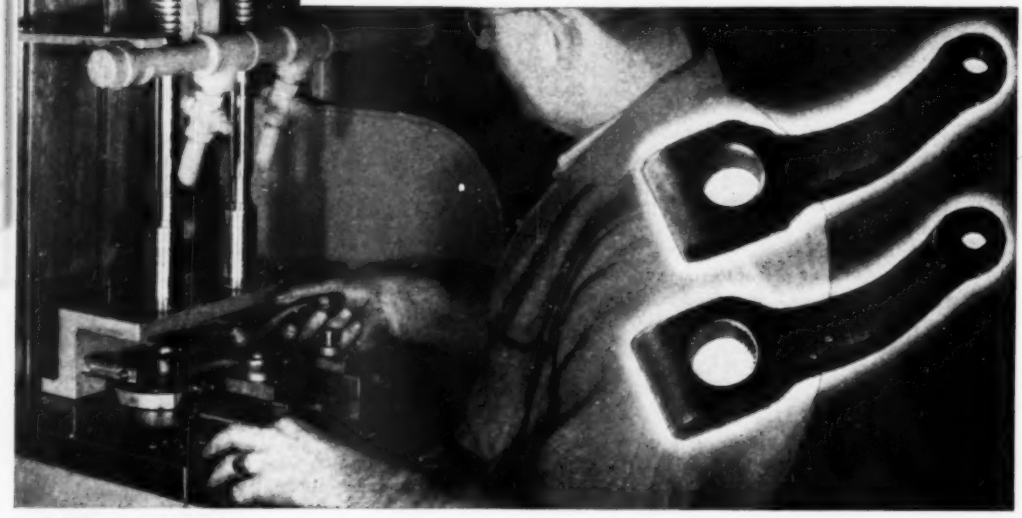
TO PUT "TEETH" IN STEERING ARMS

FASTER . . . AT LOWER COST

Two station fixture on a standard American broaching machine enables this manufacturer to broach 10 serrations in a segment of the steering arm hole and finish broach the hole in one pass. Location of the 10 serrations are maintained by index flats on the broach shanks. An economical, high-production rate of over 250 per hour was attained on an American T-10-36 vertical hydraulic broaching machine, with hydraulically operated, manually controlled broach retriever . . . arranged for two station pull-down broaching. The fixture holds one part at each station completing two parts at each stroke of the ram. Two hand manual control assures absolute operator safety.

Versatile Three-way Machines Achieve Overall Economy

Economical, high-production rates are easily attained on American type T, three-way broaching machines. Designed for inexpensive adaptation to push, pull or surface broaching, with single or multiple tooling of the ram, these three-way machines provide for low-cost conversion as production requirements change. American Engineers will be glad to make their recommendations for your broaching production. Write giving hourly requirements and part sample or drawing. Circular 100 gives full information on three-way machines. Address Dept. A.



AMERICAN *American* BROACH & MACHINE CO.

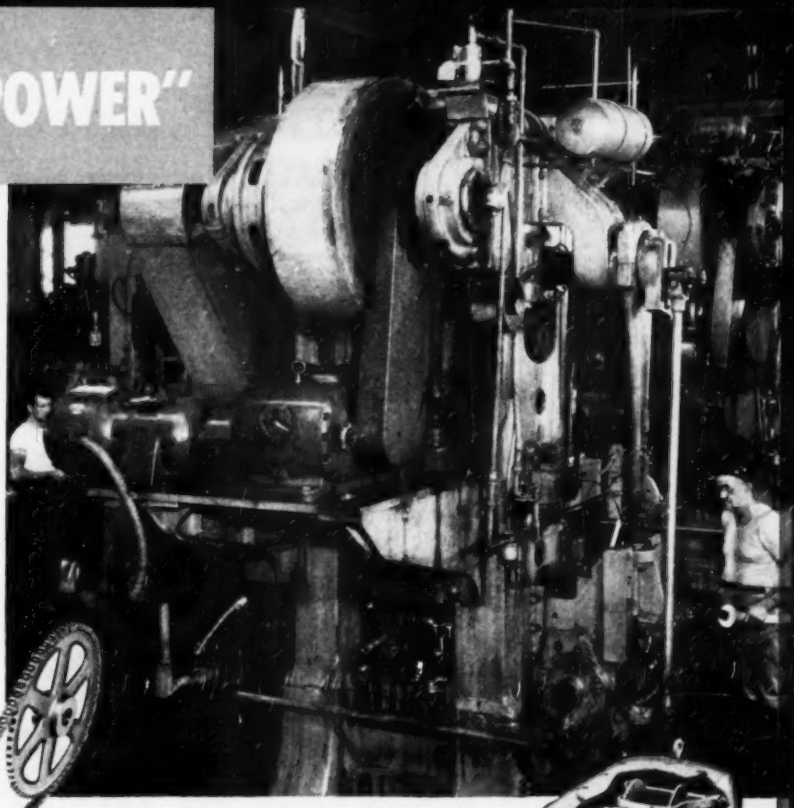
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

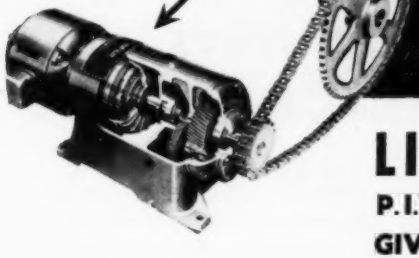
See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

"PACKAGED POWER"

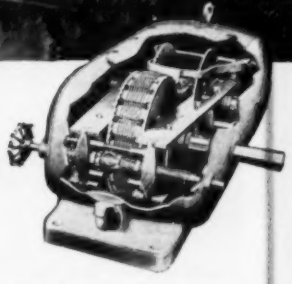
DRIVES HUGE PRESS
SMOOTHLY - - - AT
EXACT SPEED



LINK-BELT
ELECTROFLUID DRIVE
SMOOTHS OUT
SHOCK LOADS



LINK-BELT
P.I.V. VARIABLE SPEED DRIVE
GIVES PRECISE SPEED



The advantages of the Electrofluid Drive are available on virtually any power application through combination with other Link-Belt enclosed gear and chain drives. Above is shown one such combination affording shock-proof, economical power transmission at precisely controlled speed.

Three principal advantages of this drive are:

(a) **It provides smooth power transmission, assuming the load gradually, and eliminating shocks.**

(b) **It prevents damage to costly power-driven equipment and eliminates work stoppages.**

(c) **It permits the use of a smaller motor than ordinarily required to handle starting loads, improves power factor and overall efficiency.**

TYPES OF LINK-BELT POWER TRANSMISSION MACHINERY

Precision Steel Roller Chain	P.I.V. Variable Speed Drives
Silverstreak Silent Chain	Fluid Drives
Steel and Malleable Chain	V-Belt Drives
Worm Gear Drives	Ball Bearings
Herringbone Gear Drives	Roller Bearings
Helical Gear Drives	Babbitted Bearings
Gearmotors	Couplings, Clutches, Collars, etc.

Coupled with the Link-Belt P.I.V. Variable Speed Drive, this installation permits instantaneous adjustment of output speed within the smallest fraction of a revolution, to meet the exact requirements of the work in hand.

Ask for Book No. 2385 for full details and application suggestions on the Electrofluid Drive.

Book No. 1874-B gives corresponding information on the P.I.V. Variable Speed Drive.

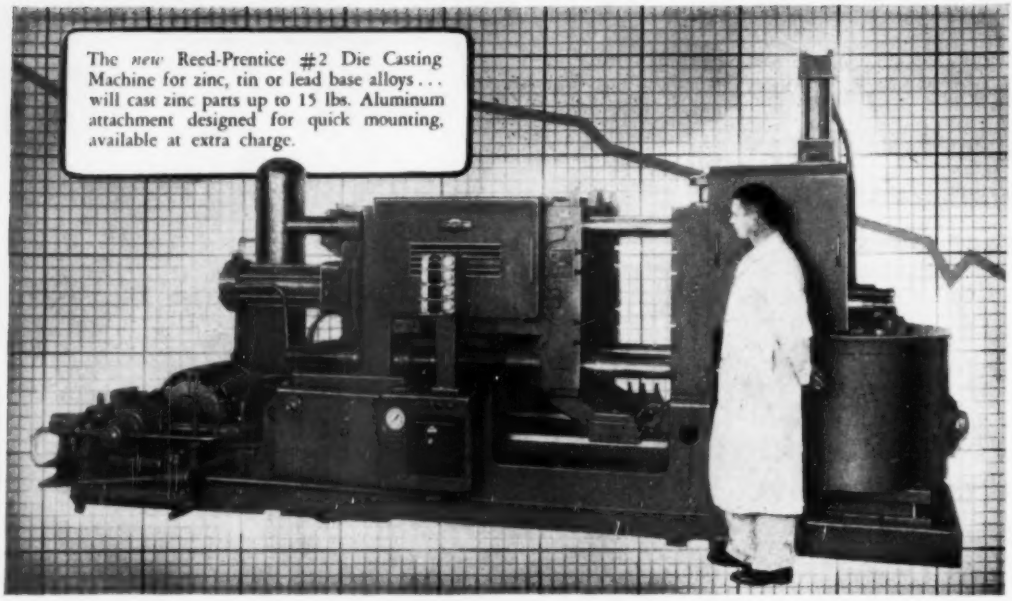
LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.
Offices, Factory Branch Stores and Distributors in Principal Cities.

11.679

LINK-BELT

Power Transmission Machinery
"THE COMPLETE LINE"


The *new* Reed-Prentice #2 Die Casting Machine for zinc, tin or lead base alloys . . . will cast zinc parts up to 15 lbs. Aluminum attachment designed for quick mounting, available at extra charge.

Cost Conscious Manufacturers are looking to DIE-CASTING!

Many leading manufacturers are using modern Reed-Prentice die casting machines to produce strong, light weight automotive parts and accessories under their own plant supervision and production.

When re-designing or planning new part specifications, it will pay you to investigate the complete Reed-Prentice die casting machine line. From the small model #0 to the big #3G (see specifications below), you will find an efficient machine for every die casting purpose within the range of 1 to 15 lbs. on zinc and 2 to 9 lbs. on aluminum. Interchangeable zinc and aluminum attachments are available at extra charge. Write Department A for specific information or circulars on the models that are of especial interest to you.

SPECIFICATIONS	#0	#1	#1G	#1½	#1½G	#2	#2G	#3G
Size of die plates	10 x 10"	16 x 21"	16 x 21"	28 x 29"	28 x 29"	38 x 36"	38 x 36"	30 x 30"
Diameter of tie bars	1½"	3"	3"	3"	3"	4"	4"	Frame type
Space between bars	8¼"	12"	12"	15 x 18"	15 x 18"	24 x 24"	24 x 24"	29"
Die opens	4"	8"	8"	10"	10"	14"	14"	16"
Maximum die space	4"	14"	14"	22"	22"	30"	30"	30"
Capacity per shot (Lbs.)	1-zinc	5¾"-zinc	2.35 alum	10½-zinc	3¾-alum	15-zinc	7-alum	9-alum
Net weight (Lbs.)	950	8,000	7,200	15,000	13,000	18,000	15,000	25,000

DIE CASTING MACHINES

REED-PRENTICE CORP.

WORCESTER 1, MASS., U.S.A.

NEW YORK 6
75 West Street

LOS ANGELES 11
2314 Santa Fe Ave.

CLEVELAND 13
1213 W. 3rd Street

The 12-V VERTICAL MILLER with ELECTRONIC DUPLICATOR CUTS DIE SINKING COST!

Close-up view of electronic duplicator attachment machining a salad fork mold.

because...

1 Accurate duplication of work can be maintained to tolerance of ±.001.

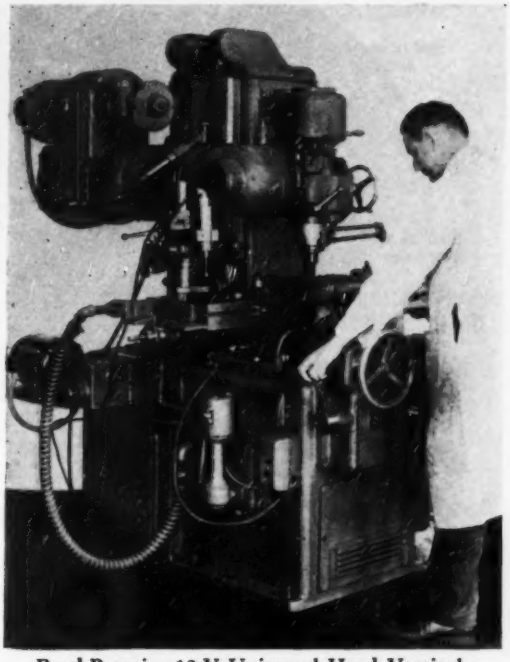
2 Conveniently located duplicator control panel allows cutter to be withdrawn and re-engaged quickly without overtravel.

3 Table feed instantly controlled from duplicator control panel when cutter approaches steep side.

4 Interlocking duplicator and feed circuit stops table immediately if duplicator stops.

in addition...

The all-purpose 12-V with Universal Head is a high speed milling and boring machine ideally suited for many other toolroom jobs. Universal head adjustment and sliding ram combined with infinitely variable feed and speed controls offer complete versatility.



Reed-Prentice 12-V Universal Head Vertical Miller with electronic Duplicator attachment.

SPECIFICATIONS

CAPACITY	
Max. distance Table to face of spindle	18"
Max. distance Spindle to column	26"
Min. distance Spindle to column	12"
HEAD	
Infinite speeds	90 to 2200
#40 NMTBA taper in spindle	
Head swivels (F & B)	45°
(L & R)	30°
Vertical Travel of spindle	5"
TABLE	
Range: Longitudinal travel	28"
Cross Travel	12"
Size: Working surface	12" x 46"
3 T-Slots (spaced 3")	11/16"
FEEDS: Infinite per Min.	
Longitudinal	¼" to 24"
Cross	¼" to 24"
Vertical of ram	5/32" to 16"
SPINDLE DRIVE MOTOR	3 HP

WRITE FOR DESCRIPTIVE FOLDER TO DEPT. A

CLEVELAND 13
1213 W. 3rd Street

LOS ANGELES 11
2314 Santa Fe Ave.

MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS., U.S.A.

NEW YORK 6
75 West Street

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

NEW!

Positive Low-Cost Motor Protection

These new Westinghouse Manual Motor Sentinels (motor starting and overload protection) are available in three types: the Standard (Nema type 1), the Water- and Dust-tight (Nema types 3, 4 and 5), the Explosion-proof (Nema types 7 and 9). These compact, handsomely styled switches start, stop and give positive protection to all motors up to one hp wherever they may be located.

Sensitive, automatic bimetallic element will pass momentary overloads and starting surges, but a dangerous overload will trip the switch immediately to disconnect the motor from the line and save it from damage. Examine these rugged new switches at your nearby Westinghouse distributor or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30007

EXTRA VALUE FEATURES

POSITIVE ACTION—Bimetallic overload protection assures safe, positive action under serious overloads.

SAFE—No exposed parts. Trip-free switch (can't be held closed against an overload) with self-indicating operating handle.

TROUBLE-FREE—Over-center toggle mechanism . . . quick-make, quick-break, double-break contacts of high-grade silver for long contact life.

ACCESSIBLE—Heaters removable from the front without disturbing any wiring. Switch always remains mounted.

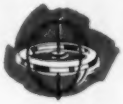
CONVENIENT—Switch unit fits any standard wall box. Straight-through wiring—all terminals are on the front.

ATTRACTIVE—Sleek, hot-molded switch unit. Standard enclosure is smooth die-casting, baked enamel over Bonderizing. Watertight and explosion-proof enclosures are sturdy cast iron.

Westinghouse

MANUAL MOTOR STARTERS

BONE TO PICK!

This appliance manufacturer was harassed by vacuum cleaner vibration. "Why not switch to a magnesium fan?" said his designer. "It would balance easier  and reduce the weight of the cleaner . . ." But the boss said he had a bone to pick with magnesium. So they put the idea up to Aluminum Company of America, light metal headquarters. They learned that simple shop practices make handling magnesium no problem.* Fellow manufacturers, they found, use over a million pounds of magnesium every month. They received valuable books on designing and fabricating magnesium, plus technical advice. Now instead of using heavy, hard-to-balance fans like this, they use light . . . uniform American Magnesium Die Castings. They're saving money . . . and their smooth-running cleaner is sweeping the country.

*No change in insurance rates.

These two, free books on magnesium and our broad technical experience can help your products, too. Write Aluminum Company of America, sales agent for American Magnesium Products, 2107L Gulf Building, Pittsburgh 19, Pennsylvania.

MAZLO
MAGNESIUM ® PRODUCTS

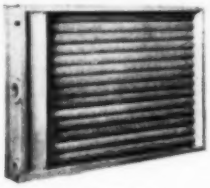
AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

YOU CAN DEPEND ON THESE STURTEVANT FANS TO CUT COSTS IN VENTILATING EXHAUSTING AND CONVEYING

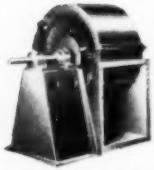
Air Conditioning Compressor

Unit Heater



Heavy Duty Heating Coil

Everything that puts air to work for Every application

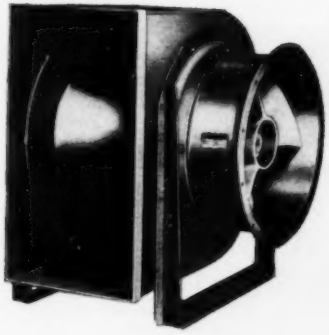


High Temperature Fan

Centrifugal Fan

Centrifugal Compressor

J-80152



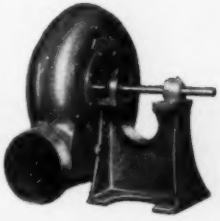
FOR HIGH VOLUME AT MEDIUM PRESSURES

The Elbow Axiflo®—A cone in the housing of this versatile fan keeps all bearings and belt drives *out of the air stream.* With steel fan wheel, you can move hot fumes or gases at temperatures up to 900° Fahrenheit, using high temperature ball bearings and shaft cooling wheel. Aluminum wheel is used for non-sparking, corrosion resisting applications. *It's dependable.*

The Straight-thru Axiflo® — For exceptionally high efficiency against outside wind and duct system resistance. Steel or aluminum wheels in a variety of mounting arrangements. *It's dependable.*

FOR LOWER VOLUME AT HIGHER PRESSURES

The Monogram®—As a conveyor, it handles materials smoothly in its cast iron casing. On exhausting jobs, it takes terrific punishment from grinding dust, grit and sand. As a blower, it's a hard working, efficient blast source for forges, burners, ovens or for cooling air for molds, machinery and hundreds of other applications. *It's dependable.*



FOR LARGER VOLUME AT HIGHER PRESSURES

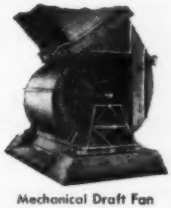
The Planovane®—Versatile—conveys, blows, exhausts. Develops the highest efficiencies of any fan of its type. Airborne particles are deflected from center of wheel, hitting back plate at an angle that helps fan action, reduces turbulence and back plate erosion. Rubber covered wheel and casing or non-corrosive metal available for handling corrosive materials. *It's dependable.*

There's a Sturtevant fan for every air-moving job in industry—a fan that is dependable and economical. Ask your nearest Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

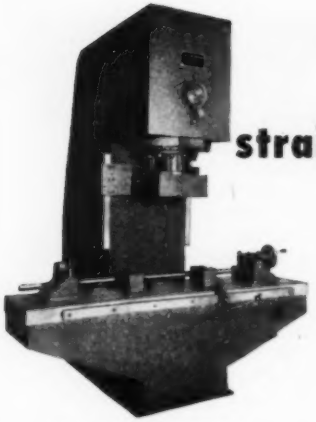
Westinghouse
Sturtevant Division

Industrial Heaters

PRECIPITRON®
(Electronic Air Cleaner)



Mechanical Draft Fan

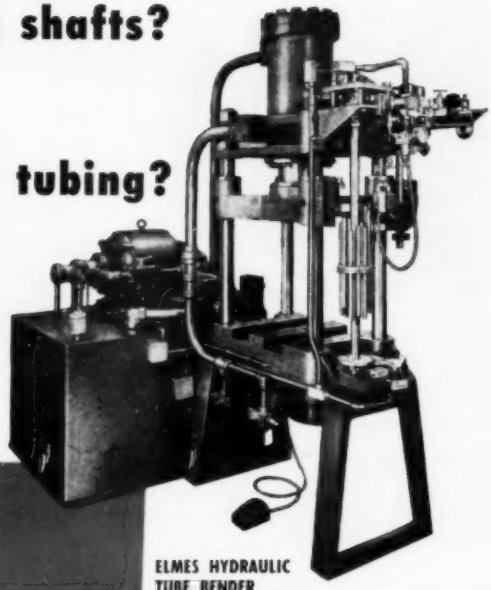


straightening shafts?

bending tubing?

ELMES OPEN-SIDE PRESS

Versatile 150-ton Model 6430, shown with fixtures for shaft straightening. 96"x24" bed. 17"x18" platen. Opening: 32". Stroke adjustable to 20".



ELMES HYDRAULIC TUBE BENDER

For forming auto exhaust pipes and other tube bending applications. A special Elmes indexing device regulates depth of bends; provides 1 to 12 different depths in succession, with automatic reset. Double cushion allows two bends to be made simultaneously.

for every pressing job *There's an* ELMES HYDRAULIC PRESS STANDARD OR SPECIAL

Producing special-purpose equipment is an *important part* of Elmes service to the metal-working industry. The two examples illustrated here do not begin to show the broad and varied range of Elmes Special-Purpose Press application.

Elmes Special-Purpose Hydraulic Presses may be *standard* designs modified for specific kinds of work. They may be existing designs with modifications in any of *many* features. Or they may be entirely *new* designs. With thousands of drawings for reference, and with existing patterns, Elmes can furnish you with special presses *without* burdening development costs.

There can be no substitute for long experience when it comes to solving new problems. That's why special Elmes equipment is so *favorably* known, so *widely* used, throughout the metal-working industry. If *you* have a special metal pressing operation, why not put your problem up to Elmes? Elmes ingenuity and skill are positive assurances of *press performance at its best!*

ENGINEERED BY ELMES

Good Hydraulic Production Equipment Since 1851

Write for New ELMES Bulletin No. 1010B

"HYDRAULIC METAL-WORKING PRESSES"

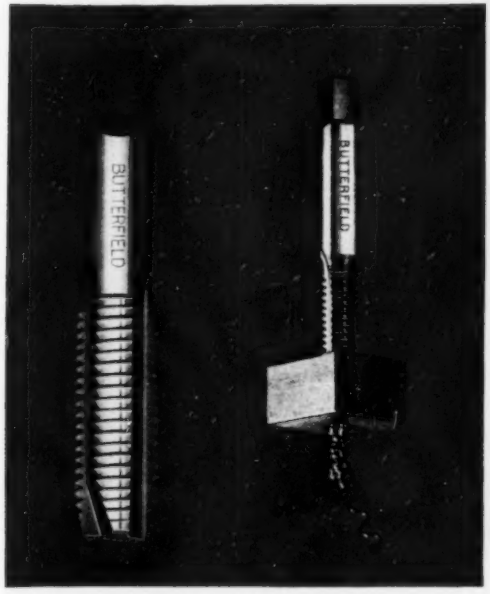
Illustrates, describes and gives major specifications on Elmes hydraulic single-action, double-action, and triple-action presses; standard designs; special designs; automatic feeds. Your Elmes Distributor can supply you, or request from us direct—on your business letterhead, please.

ELMES ENGINEERING DIVISION of AMERICAN STEEL FOUNDRIES · CINCINNATI 29, OHIO

Distributors in Principal Industrial Centers ● *Also Manufactured in Canada*

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

Let the chips fall either way!



CHIPS CURL DOWN and out of deep through holes when you use Butterfield Ground Thread Spiral Pointed Taps — right hand cut, left hand spiral points. No chip clogging in the flutes. These taps also recommended for blind holes when drilled deeply enough to allow clearance for chips at bottom of hole.

CHIPS SPIRAL UP and out of blind holes that have little or no chip room at the bottom when you use Butterfield Ground Thread Spiral Fluted Taps — right hand cut, right hand spiral flutes. Flutes are milled to the correct degree of spiral allowing tap to cut freely while ejecting chips from hole.

INSIST ON BUTTERFIELD GROUND THREAD TAPS

Whether you want to tap blind holes or through holes, there's a Butterfield Tap to meet your need . . . to cut smooth, accurate threads in aluminum, magnesium, brass, copper, zinc and similar materials. What's more, because they're *Butterfield*, you get extra assurance of top performance, maximum savings in time and money. *Every Butterfield Tap is individually inspected.* These taps, too, are *ground thread*... providing maximum accuracy and savings by fewer wasted threaded parts.

For quick deliveries, depend on your nearby Butterfield Distributor. Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec.

BUTTERFIELD

THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES

Want User Benefits in Protection? Style? Comfort?

. . . THIS AO METAL SPECTACLE GOGGLE HAS THEM ALL!

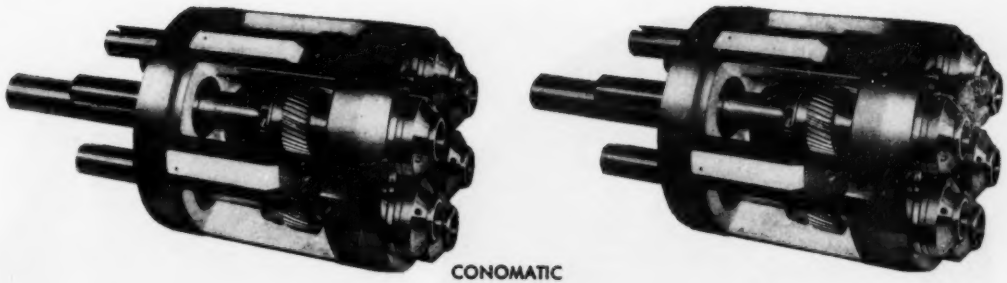
Yes, the AO F-3100 Metal Spectacle Goggle gives workers "all three" *plus* unobstructed view of the work! Specify this proved preventer of eye accidents (and their high costs). Side shields give added protection when there is also exposure to particles striking from the side. Your nearest AO Safety Products Representative can supply you.

FEATURES:

- High-set end pieces take hinges and temples out of line of sight for unobstructed vision. High position of end pieces also keeps goggles up on nose for smart appearance.
- Double-braced bridge for exceptional structural strength.
- Orbit shape of lenses conforms to eye. Close fitting frame for maximum protection.
- Universal pivot support permits nose pads to adjust to sides of nose. Large size pads distribute pressure over greater area for comfort.
- Temples are insulated, perspiration proof, heat resistant.
- Side shields (when specified) are perforated, wire mesh, non-corrosive, easily cleaned and provide ample air circulation.
- Six Curve Super Armorplate clear or Calobar lenses in medium, dark or extra dark shades.
- Sizes: 42 mm., 44 mm., and 47.7 mm.; 21, 23, and 25 mm. bridge sizes.

American Optical Company
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities



CONOMATIC
1½" 6-Spindle
CARRIER

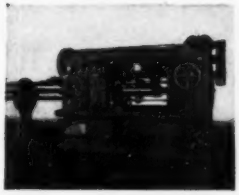
CARRIER FRAME INFORMATION		CARRIER FRAME INFORMATION
Rugged	ARE YOU	1. One piece — 615 pounds 2. Nickel Moly Iron (normalized) 3. Overall Length — 20" 4. Bearing Length — 5.04" 5. Bearing Area — 306.6 sq. in. (Full information available)

SUBJECT TO WITHHOLDING?

The withholding of information regarding the facilities of machine tools would be unintentional. But the use of generalizations and approximations, instead of specifications, actually is withholding. Generalizations fail to establish the superiority of a machine's facility through terms which lack a definite basis of comparison. They leave an impression of doubt as to tangible substantiation.

There is nothing definite about a "roomy" tooling area; nothing specific about a "rugged" tool slide, and nothing comparative about a "massive" frame.

The dispensing of machine information is the responsibility of the manufacturer. Realizing this, CONE has prepared an analysis chart that should prove very useful to those seeking more specific information about multiple spindle automatic bar machines. Your copy is free. There is no obligation.



A comparison with ALL Automatics will lead you to

Conomatic

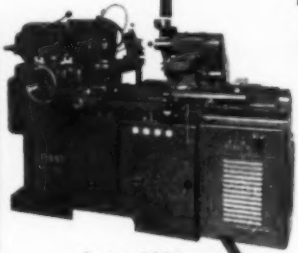
CONE AUTOMATIC
MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

A fine line

of Internal Grinders for every tool room and production requirement

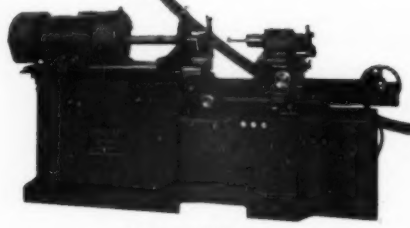
Series 1460

Series 1109



Series 1116

BRYANT has designed and built precision internal grinders for 38 years. Today, their completely modern line covers the grinding of holes from .040" to 50" in diameter. Standard and special machines will grind straight, tapered, curved and irregular holes, or any of these in combination. Face and hole grinding can be combined to assure squareness. Cams and irregular holes can be ground by using the cam attachment. The Series 1460 has a face plate 60" in diameter and will swing work up to 50". A special machine will take 100" swing. The Series 1109 is equipped with Bryant High Frequency wheelheads giving speeds up to 100,000 R.P.M. for extremely small bores. Maximum swing of the 1109 is 9". Series 1116 machines are for general purpose tool room work. They incorporate many quick-changeover features and will swing 16". The 1416 machines are similar to the 1116, but have provision for grinding long bores such as machine tool spindles. Series 1216 grinders are completely automatic and will grind bores from 3/16" to 6" in diameter. The High Frequency head is used on the 1216 for maximum efficiency on small bores. All these machines incorporate the exclusive Bryant feature of hardened and ground cylindrical slide construction and three-point bearing. Complete specifications are available on all Bryant precision internal grinders — write today.



Series 1416

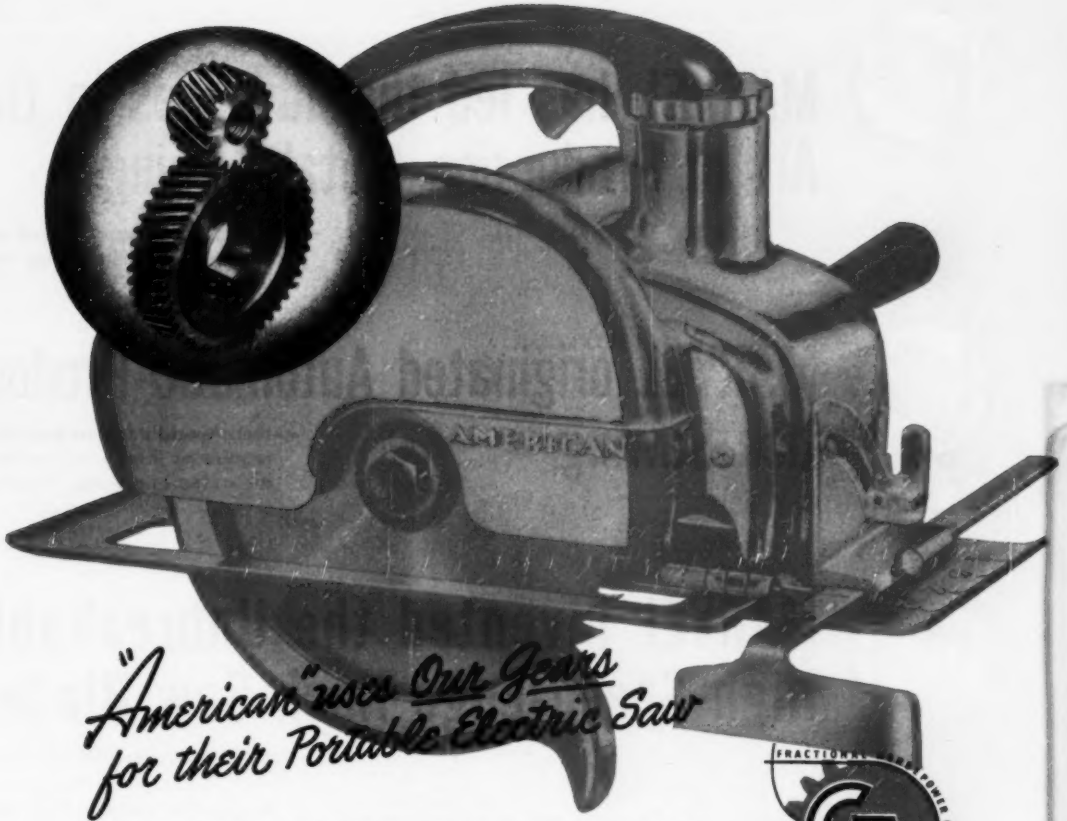
Series 1216

Send for the Man from

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

BRYANT



"American" uses Our Gears for their Portable Electric Saw

THE American Floor Surfacing Machine Co. is well known for the rugged dependability of their portable electric equipment. Important components in the sensational new portable electric saw by "American" are the alloy bronze Gear and the heat treated alloy steel Helical Pinion Gear made by our skillful craftsmen. G.S. Fractional Horsepower Gears contribute substantially to the smooth operation, long life and all round efficiency of this *better* saw. If the *quantity* production of finer, *more uniform*, Small Gears is an essential requirement in your business, by all means take advantage of the highly specialized service we give. *Today* . . ask our engineers for suggestions, and low cost estimates. You won't be obligated to buy.

SEND FOR OUR CATALOG BULLETIN

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

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2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

MARVEL has led the advances in the Art of Production Metal Sawing

—has greatly increased speed and accuracy, while lowering cost.

MARVEL originated Automatic Production Sawing

—these world's fastest hack saws require no more attention than an automatic screw machine.

MARVEL invented the Unbreakable High-Speed-Edge Hack Saw Blade

—this "Production" blade permits continuous operation at far far greater speeds and feeds.

MARVEL developed the "Production" Hole Saw

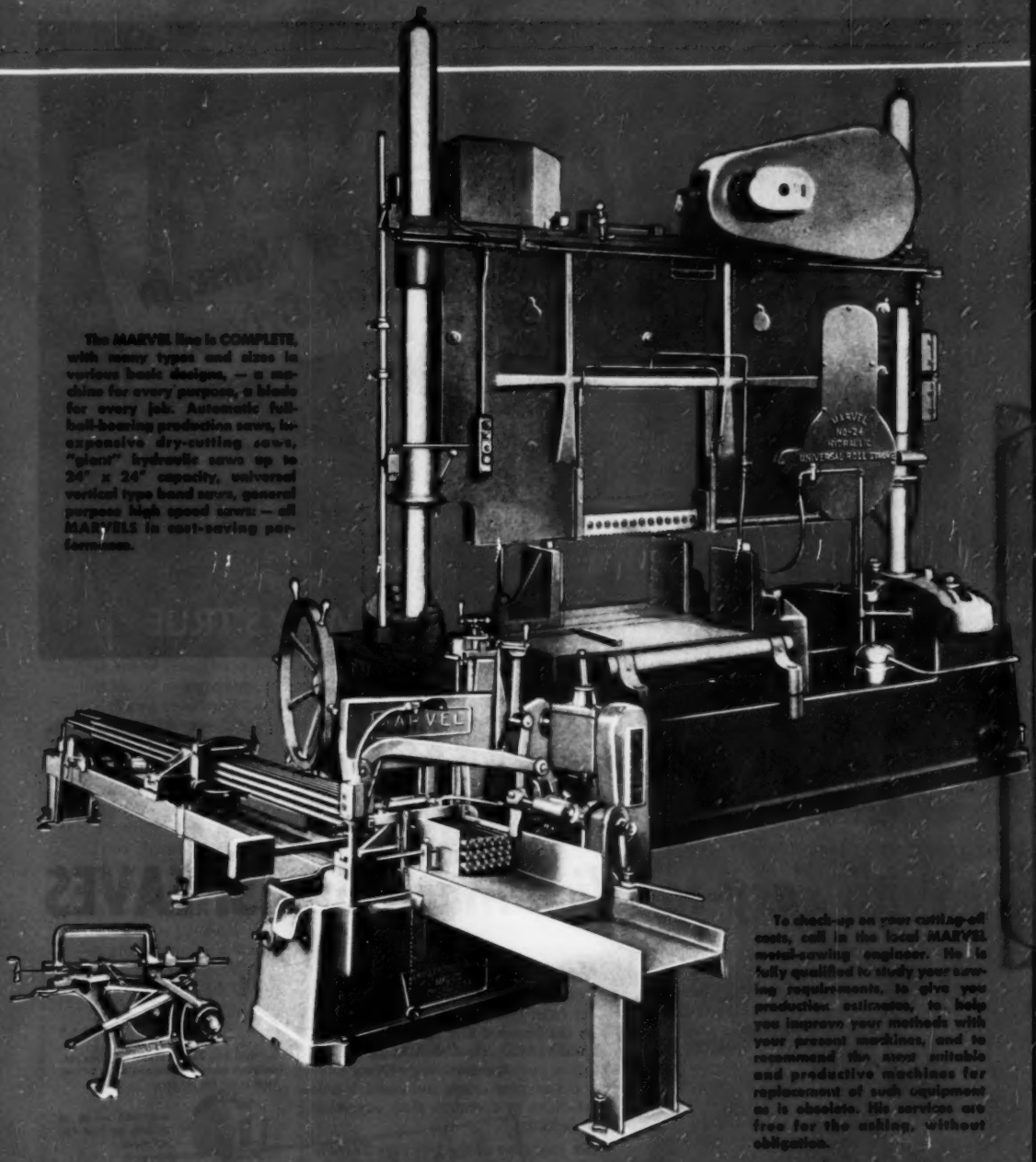
—a new tool that permits lathes and drill presses to saw-cut large holes from heavy plate at low cost.

MARVEL developed the Universal Band Saw

—saves hours of machining by "roughing" to size and shape.

To-day, Fast, Accurate Sawing means MARVEL.

The MARVEL line is COMPLETE, with many types and sizes in various basic designs, — a machine for every purpose, a blade for every job. Automatic full-ball-bearing production saws, inexpensive dry-cutting saws, "giant" hydraulic saws up to 24" x 24" capacity, universal vertical type band saws, general purpose high speed saws: — all MARVELS in cost-saving performance.



To check-up on your cutting-off costs, call in the local MARVEL metal-sawing engineer. He is fully qualified to study your sawing requirements, to give you production estimates, to help you improve your methods with your present machines, and to recommend the most suitable and productive machines for replacement of such equipment as is obsolete. His services are free for the asking, without obligation.

Write for Catalog

Metal Cutting

MARVEL SAWS

Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO, 5700 BLOOMINGDALE AVE., CHICAGO 39, ILLINOIS

Save Mounting Time

With *Easy-to-Align* Magic-Grip SHEAVES

YOU CAN MOUNT a *Magic-Grip* sheave faster than any other sheave you can buy . . . and demount it just as fast. To mount, simply slide the sheave onto the shaft and tighten three screws. To demount, use the screws to break the grip of the tapered bushing and the sheave can be slid off easily.

You save time and eliminate the danger of damaged bearings and shafts from forcing and hammering. A hex socket wrench is the only tool needed and anyone can line up the sheave perfectly. Sizes 1 to 250 hp.

Most Complete V-belt Line

Get everything you need for your V-belt drives from one reliable source. *Texrope* offers the broadest line of V-belts, standard and variable-speed sheaves and speed changers plus the extra engineering skill that comes from more industrial V-belt installations in operation than any other manufacturer.

Get your copy of the 144 page *Texrope* Pre-Engineered Drive Manual from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956. Also in Sweet's. A-2855

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MILWAUKEE, WIS.

Texrope and *Magic-Grip* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

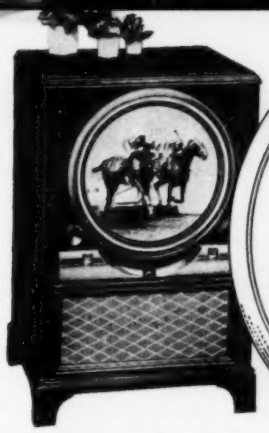
by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

Over 80% of the presses at Zenith Radio —are Bliss!



The *St. Regis*, a triumph of Zenith's television design and engineering, contains a variety of stampings made on Bliss presses.

Complex die in Bliss No. 28 Press punches 35 holes in automobile radio speaker and trims outside area. Material is 20 gauge steel. Press operates at 45 S.P.M.

First and second operation samples of punching and trimming automobile speaker. Blank is drawn to full depth and center hole pierced in first operation on 75-ton new Bliss Inclinable.

When Zenith Radio Corporation needs presses for the thousands of stampings that go into their extensive line of radios and television sets, hearing aids, and automotive radios—*they specify Bliss.*

W. Dumke, Vice President of Zenith, and O. Westad, Press Room Supervisor, have been able to compare the performances of many different makes of presses in their long radio manufacturing experience. That's why 80 per cent of Zenith's stamping equipment, *and over 95 per cent of the presses purchased in recent years*, have been supplied by Bliss. These include batteries of straight side, inclinable, and horning presses.

More reasons? Let's look at the record. In 1947, Zenith installed 40 new Bliss presses and has used them ever since, mostly on short press runs requiring frequent die changeovers *—without mechanical difficulty.* The Bliss Inclinables, which are being used currently to stamp out parts for the Zenith television sets, are "a happy combination of ruggedness and simplicity," according to Dumke and Westad. They regard highly, too, the Bliss Rolling Key Clutch—for its dependability and speed of action.

This overwhelming preference for Bliss equipment at Zenith is duplicated in every major pressed metal industry...from one end of the production line to the other. Bliss supplies not only a press, but also a 90-year fund of engineering and production knowledge designed to help *your* plant...as it has helped plants like yours...solve its production problems. It will pay you to send for a Bliss sales engineer today.

E. W. BLISS COMPANY, TOLEDO 7, OHIO

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

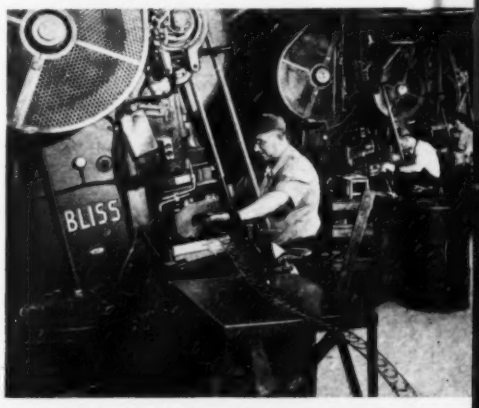
WORKS AT: Toledo, Salem, Ohio; Hastings, Michigan; Derby, England; St. Ouen sur Seine, France

ASK ABOUT OUR NEW DEFERRED PAYMENT PLAN

1-3 years to pay — 25% down

3¼% average yearly interest on original balance

No finance charges



Battery of Bliss No. 21½ Inclinable Presses stamp out parts for radio, television sets, and hearing aids at Zenith. Bliss straight side and horning type presses round out Zenith's production line.

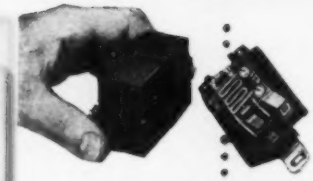
BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY IN THE WORLD

BLISS BUILT

INCREASED VALUE

no increase in price

manual motor starters...



The CR1061 controls a handkerchief ironer in a modern laundry.

.... feature quick, easy installation; positive overload protection with long-life bi-metallic relays; easy wiring and servicing because terminals are wired from the front. Application—fractional and integral motors up to 7½ horsepower.

The CR1062 is easy to mount and wire. Used here on a coolant pump.

Roomy, attractive case can be mounted on or beside the machine. Sturdy switch mechanism resists vibration. New push-button as well as toggle-type forms now available for integral motor starting. All forms—watertight, dust-tight, and explosion-proof—available in both lines. Write now for more information. *Remember, these new starters have all the features you've been wanting at no increase in price.*

General Electric Company
Apparatus Dept., Sec. B730-9
Schenectady 5, N. Y.

Please send me—
Bulletin GEA-2234E on CR1061 Fractional-hp Motor Starters
Bulletin GEA-1522F on CR1062 Integral Motor Starters

NAME .....

COMPANY .....

ADDRESS .....

GENERAL ELECTRIC

20% to 30% SAVINGS!

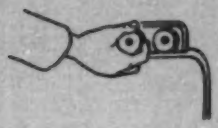
with NORTON TYPE CTU Cylindrical Grinders

1. The Famous NORTON Wheel Spindle Unit
2. Norton Micrometric Revolving Feed Screw Mechanism
3. Quick-Action Pre-Set Truing and Grinding Speed Control
4. "One-Lever" Grinding Cycle Control for Semi-automatics
5. Instant-Action Automatic Feed Rate Controls
6. Feather-Touch Work Jogging Lever
7. No-Search "Click-Count" Wheel Feed Mechanism
8. Automatic or Manual Coolant Flow
9. Automatic Wheel Feed at Table Reversals
10. Finger-Tip Automatic or Manual Work Rotation Selector
11. Either-End Table Dwell Control
12. Silky-Sure Hand Table Traverse
13. Floor-Space-Saver Ribbon Type Base Way Guards
14. Close-Approach Rear Base Design
15. Quick-Clean Coolant Ramp
16. Swing-Back Wheel Guard Cover
17. Stand-Up Electrical Controls Mounting
18. Knee-High Hydraulic and Lubricating Pump Mounting

The new CTU's production, design and maintenance features are "paying-off" in substantial savings

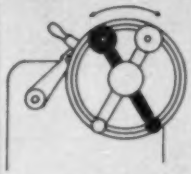
The NORTON CTU *is* a Real Cost-Cutter . .

Production Conveniences



Feed Rate Controls are all conveniently set from front of machine.

Pre-set Truing and Grinding Speeds. Proper speeds set from first piece on job. Lever movement brings one or the other thereafter —no search or try.



Automatic Wheel Feed at table reversals— with automatic re-set after grinding to size.

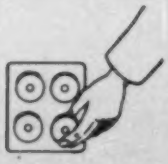


Table Dwell Controls, both right hand and left hand, are adjustable separately and located hand-high directly in front of operating position.

Feather-touch Work Jogging Lever enables work to be jogged at any time whether work rotation is being automatically or manually governed.

Why Is the Type CTU such a cost-cutter?

Because it's a completely *new* grinder—not a modernized version of an old machine. *In no other cylindrical grinder* will you find so many operating and maintenance conveniences, so many exclusive design features.

And these advantages of the new CTU are being proved in plant after plant. For example:

A Prominent Producer of Electric Motors says—

"An average saving of 31% with CTU s over previous cylindrical grinders."

A Transmission Manufacturer reports—

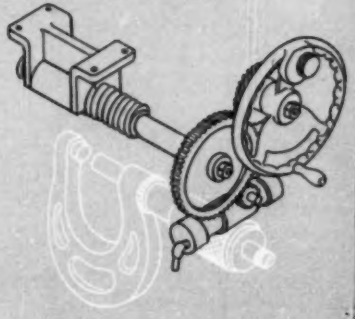
"Savings of 20 to 25% with the new Norton CTU."

An Automobile Maker comments—

"In addition to substantial savings on an axle shaft grinding operation, our Grinding Foreman says, 'This is the best grinder that has ever been produced. It runs day and night and never a sign of trouble.' "

TWO OUTSTANDING DESIGN FEATURES

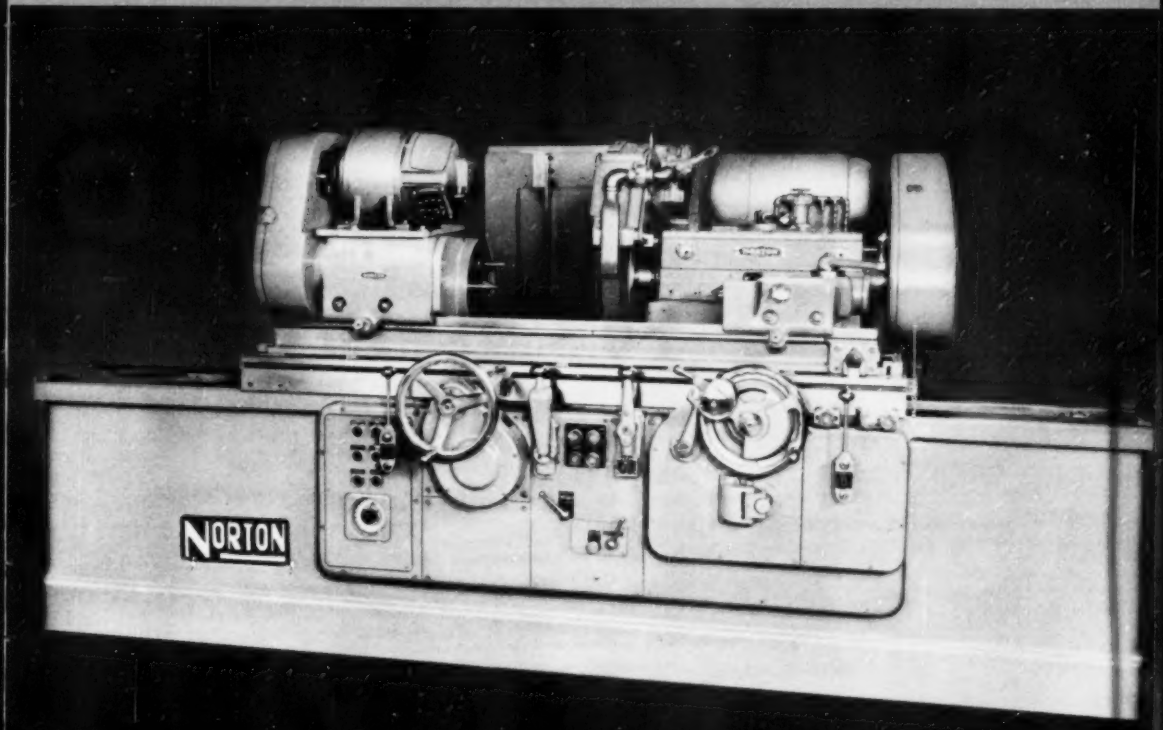
THE NORTON WHEEL SPINDLE UNIT—over 50% of spindle body supported in two super-duty size, hard bronze bearings. Spindle stays on its fixed center line—no shifting possible. Flood lubrication is automatic, filtered, self-contained within wheel slide.



THE NORTON MICROMETRIC REVOLVING FEED SCREW MECHANISM provides complete metal-to-metal contact during grinding feed portion of cycle—a feature that insures prolonged accuracy.

NORTON

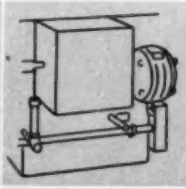
. . Definitely *Proved* in Plant after Plant!



NORTON 10 x 36" TYPE CTU
SEMIAUTOMATIC CYLINDRICAL GRINDER

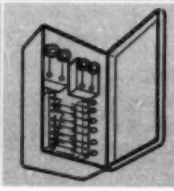
Maintenance Conveniences

Steel "Ribbon Type" Base Way Guards require no floor space, and are highly efficient at minimizing grit infiltration.



Pumps and Motors are mounted outside of base, knee-high, to insure convenience in maintenance and service.

Clean-out Ramp cast into rear base for rapid, easy sludge removal. This greatly reduces clean-out time.



Elevated Electrical Control Cabinet makes servicing possible in standing position—and avoids floor level dust and dirt.

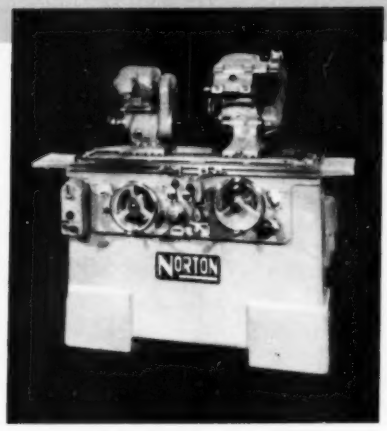
These features of the new CTUs and many more are illustrated and described in detail in four new catalogs. No. 157-2 covers the 6" plain, No. 1488-1 the 6" semiautomatic, No. 166-2 the 10" plain and No. 1787-1 the 10" semiautomatic. Write for any or all—no obligation.

Can You Afford to Continue with Any Other Grinder than the CTU?

Four Other New NORTON COST-CUTTERS

The No. 20 Cutter and Tool Grinder

The highly versatile, ***tilting wheel head*** machine for general tool room service. Catalog No. 189-2 for details.



The 10 x 20″ Universal Grinder

The wide range universal machine with a ***1″ clear-through hole*** in head-stock spindle. Catalog No. 170-2 for details.

The 8″ Hydraulic Surface Grinder

At home in tool room or production line. ***Continuous hydraulic cross feed*** a real feature for truing. Catalog No. 190-2 for details.

The Type 16 FC Lapping Machine

The vertical lapping machine that produces optically flat surfaces and thickness tolerances ***in millionths.*** Catalog No. 212-2 for details.

GRINDERS **NORTON** LAPPERS

NORTON COMPANY, WORCESTER 6, MASS.

New York • Detroit • Chicago • Cleveland • Hartford

Distributors in All Principal Cities

CTU Bulletin No. 1 11-49

Printed in United States of America

ABRASIVES • GRINDING WHEELS • GRINDING AND LAPPING MACHINES • REFRACTORIES • POROUS MEDIUMS • NON-SLIP FLOORS • BORON CARBIDE PRODUCTS • LABELING MACHINES • CAPSULATING MACHINES

How Parker-Kalon Helps You

FIT THE FASTENER TO THE JOB

To Reduce Assembly Costs

In designing for lower costs, have you questioned the efficiency of the *fasteners* you use? In 7 out of every 10 cases, Parker-Kalon Self-tapping Screws permit savings up to 50% in assembly work hours.

With P-K Screws, you eliminate such job-slowing operations as tapping, riveting, nut-running, and inserts in plastics. But other big advantages — simplified assemblies, lower production costs, and often improved product performance — lie in Parker-Kalon's ability to *fit the fastener to the job.*

Originators of the Self-tapping Screw, Parker-Kalon can draw upon 35 years experience in solving application problems — more than a million of them. And, with a complete line of Self-tapping Screws for every metal and plastic assembly, Parker-Kalon advice is unbiased.

Today — call in a P-K Assembly Engineer. Find out the possibilities of using this simpler, speedier fastening method in your assembly for cost reduction and improved design. Or, mail assembly details for recommendations. Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y.

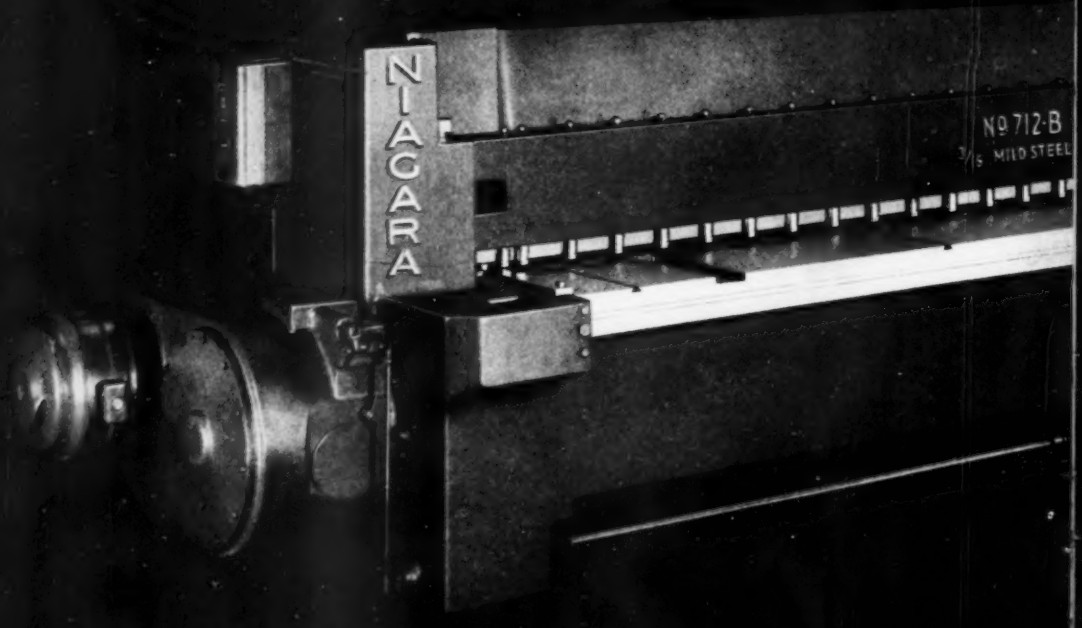
Remember
IF IT'S P-K ®
... IT'S O.K.!

The Original **PK®** **PARKER-KALON®**

SELF-TAPPING SCREWS

FOR EVERY METAL AND PLASTIC ASSEMBLY

APPROVED by the LEADERS of INDUSTRY



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NIAGARA

America's Most Complete Line of

PRESSES
SHEARS
MACHINES
and **TOOLS**
for Plate and
Sheet Metal Work

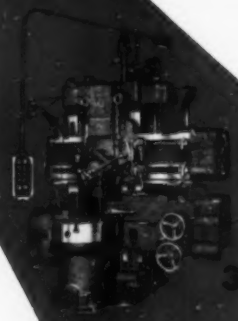
DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK

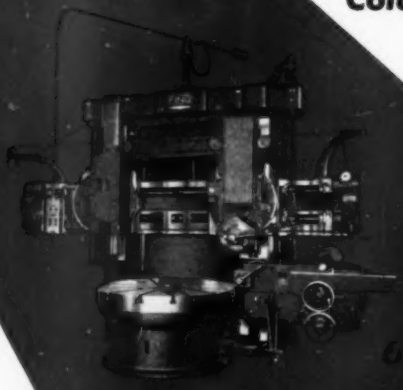
10 SIZES...

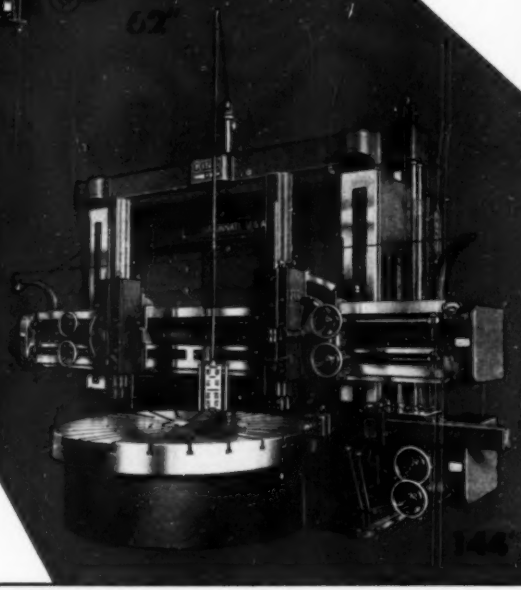
Single Column } **30", 36", 42"**

Double Column } **52", 62", 72", 84", 100", 120", 144"**

All sizes available with or without side head







Widest SIZE RANGE

among general-purpose vertical boring & turning machines is the KING Size Range... 10 sizes, from 30" to 144"... providing the *right* mill for your particular boring, facing, and turning work — large, medium, or small. Full description and specifications sent promptly on request.

KING

VERTICAL BORING & TURNING MACHINES

American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

broaching will really save you money on those close tolerance high speed internal gears

HERE'S AN ACTUAL CASE:

The Old Production Line-Up	The Way It's Handled Now
1. Rough Broach	1. Rough Broach
2. Shape	2. Finish Broach
3. Shave	
Required Tolerance .0002"	Required Tolerance .0002"

EQUIPMENT USED:

1 Broaching Machine	4 Broaching Machines
18 Gear Shapers	
2 Gear Shaving Machines	

These are actual figures from a well known automotive gear plant which adopted the all-broaching procedure about 2 years ago. Since then savings have been spectacular.

Of course they don't use the garden variety of broaches. The savings and precision achieved would not be possible with ordinary tools.

This plant uses NALOY BROACHES each of which is good for 38,000 gears before it is retired. Naloy broaches have characteristics (and we can prove this) that the average broach shop just doesn't have the facilities to duplicate.

If you want Precision with maximum economy, send for a Red Ring Broach Engineer.

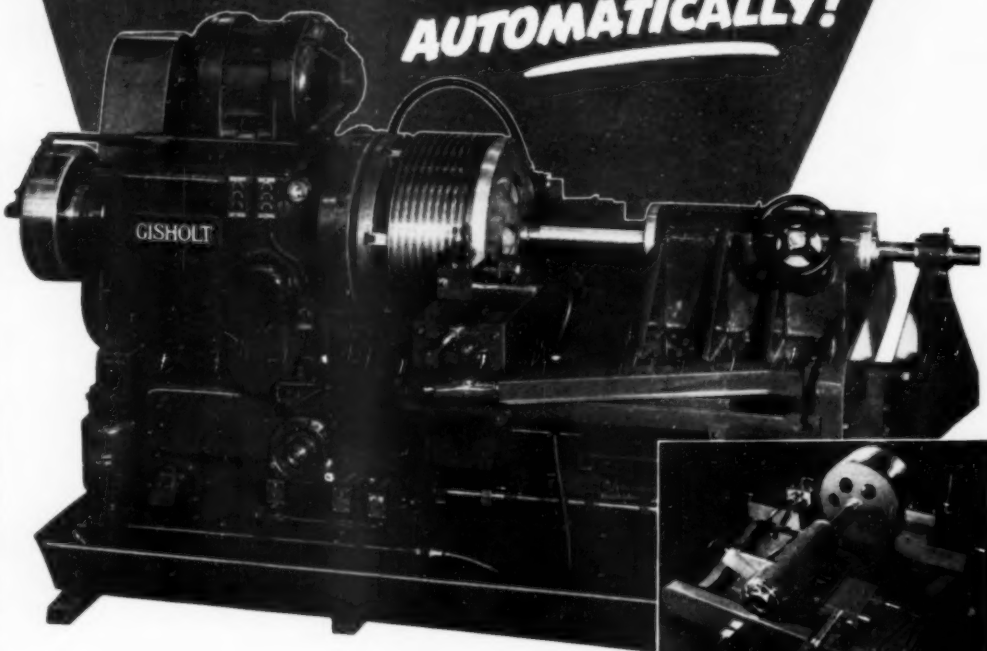
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

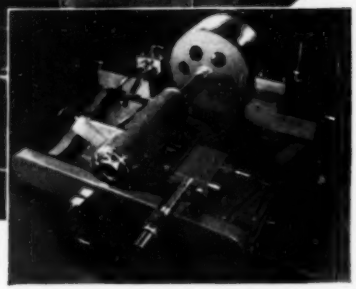
NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

How the SIMPLIMATIC machines 212 different multiple V-belt sheaves AUTOMATICALLY!

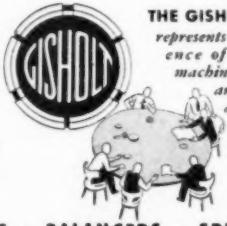




Automatic pawl fitting into notched bar sets groove position. A single tool bit on the front slide roughs, while the tool bit on the rear slide finish forms. At end of cut, table is automatically repositioned for next groove. Spindle stops and table retracts automatically at end of job.

Here's an extremely diversified job which involves 3 different sheave diameters, 3 different groove sizes—and with from 3 to 10 grooves on each sheave . . . a total of 212 different combinations! Yet the entire job is simplified to *one* machine—the Gisholt SIMPLIMATIC. The SIMPLIMATIC handles them all automatically—with various pick-off gears and face clamps. The grooves are machined progressively one at a time to avoid excessive heat and strains in the workpiece. Total machining time ranges from 2.7 minutes for the smallest to 11.5 minutes for the largest.

It's one more example of the amazing versatility of this automatic machine. Investigate the SIMPLIMATIC before you invest in a special machine.



THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

NIAGARA

Announces a New, Low-Priced

POWER SHEAR FOR LIGHT SHEET METAL

● Here is the new high speed Power Shear that sheet metal men have been waiting for. New advanced engineering . . . new styling . . . new, easy, fast operation.

THE GREATEST DOLLAR for DOLLAR SHEAR VALUE YOUR MONEY CAN BUY

● This new Niagara high speed Power Shear is designed for light sheet metal work. One look at its distinctive styling indicates its modern performance.

Fabricated from unbreakable steel plate, it is engineered to combine strength and stiffness for accurate cutting.

Clear visibility of cutting line through cut-outs and over the top of holddown facilitates shearing to an accurate layout line.

Niagara Alloy Tool Steel Knives heat treated to a high degree of hardness and toughness and precision ground for accuracy provide keen cutting edges for longer service between grinds.

Quick Acting Back Gauge and convenient front and side gauges.

Capacity—20 gauge.

30, 36 and 42 inch cutting lengths

125 cuts per minute.

Write for complete information and low prices

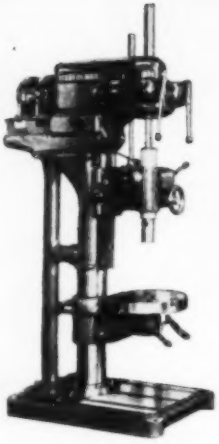
See how the new PANCAKE MOTOR DRIVE provides the most compact construction ever obtained... minimum floor space, maximum safety.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, NEW YORK

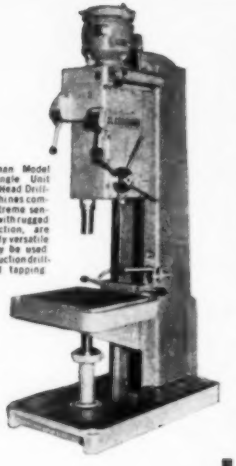
DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK

THE CLEEREMAN LINE

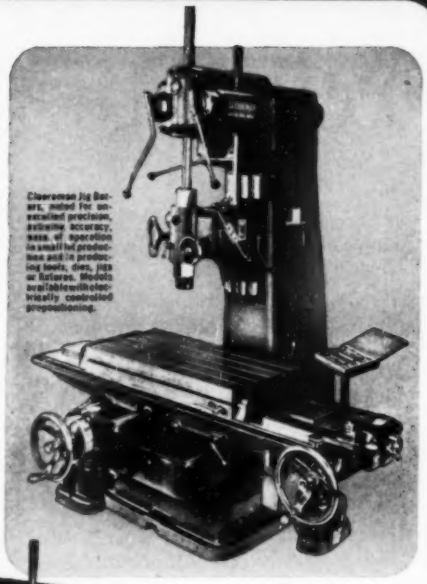
OF PRECISION JIG BORERS and DRILLING MACHINES



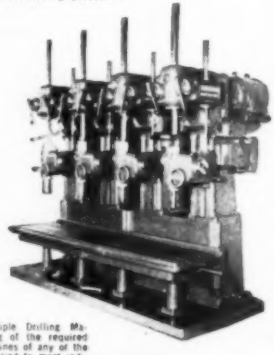
Cleereman Round Column Drilling Machines produce accurate holes at high speed and at low cost and are general purpose machines with high production.



Cleereman Model 325 Single Unit Sliding Head Drilling Machines combine extreme sensitivity with rugged construction, are extremely versatile and may be used for production drilling and tapping.

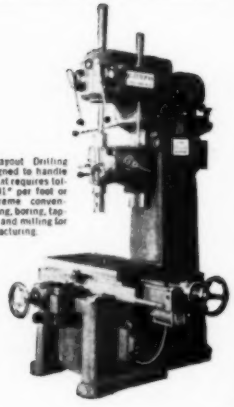


Cleereman Jig Borers, noted for unexcelled precision, extreme accuracy, ease of operation in small lot production and in producing tools, dies, jigs or fixtures. Models available with electrically controlled prepositioning.



Cleereman Multiple Drilling Machines consisting of the required number of machines of any of the three types supplied to meet individual requirements.

Cleereman Box Column Drilling Machines have an exceptionally rigid construction for continuous heavy duty work combined with accuracy and the speed required for low cost production.



Cleereman Layout Drilling Machine designed to handle layout work that requires tolerances of .001" per foot or broader. Extreme convenience for drilling, boring, tapping, reaming and milling for jigless manufacturing.

BRYANT Machinery & Engineering Company

General Office
400 West Madison Street, Chicago 6
Representatives in Principal Cities

Affiliated with—

CLEEREMAN MACHINE TOOL CO. Green Bay, Wis.

BUILDERS OF PRECISION JIG BORERS & DRILLING MACHINES

This enlargement represents a 1/16" dot of fabric in a 51-gauge stocking. It shows the loop formation that provides such great elasticity.
Did you know? that in "20-denier" sheer nylon hose, the diameter of the yarn is .00197".
Did you know? that in a "51-gauge" stocking, each square inch of main leg fabric consists of 3536 loops.

It takes 1,568,586 loops (AND FORTY MINUTES) to make a single 51-gauge stocking

High-Production Full-Fashioned Knitting Machines, 52'9" long and capable of knitting thirty stocking blanks simultaneously, are produced by the Textile Machine Works, Reading, Pa. With a total of 14,280 needles, each of its thirty sections lays a course of 476 loops in less than a second . . . yet it takes close to forty minutes to knit the one-and-a-half million loops required for a single 51-gauge stocking blank.

With so many moving parts, it wasn't easy to obtain the necessary smoothness of operation at high speeds. Precision, balance and long-wearing-and-bearing qualities had to be built into each of the machine's components—420 of which are made of twelve different Anaconda Extruded and Drawn Brass Shapes.

These shapes, made of wrought metal, are tough, strong, dense-grained and smooth-surfaced, with cutting characteristics that make them ideal for such precision-machined parts as those illustrated below. Besides, these parts are now being produced at a saving of 25 to 30% over the cast-brass sections they replaced.

The cost-paring advantages of Anaconda Extruded and Drawn Shapes are not limited to the textile industry. Produced in copper, brass, bronze or special copper alloys, they are available in an infinite variety of cross-sections. For further information, write to The American Brass Company, General Offices: Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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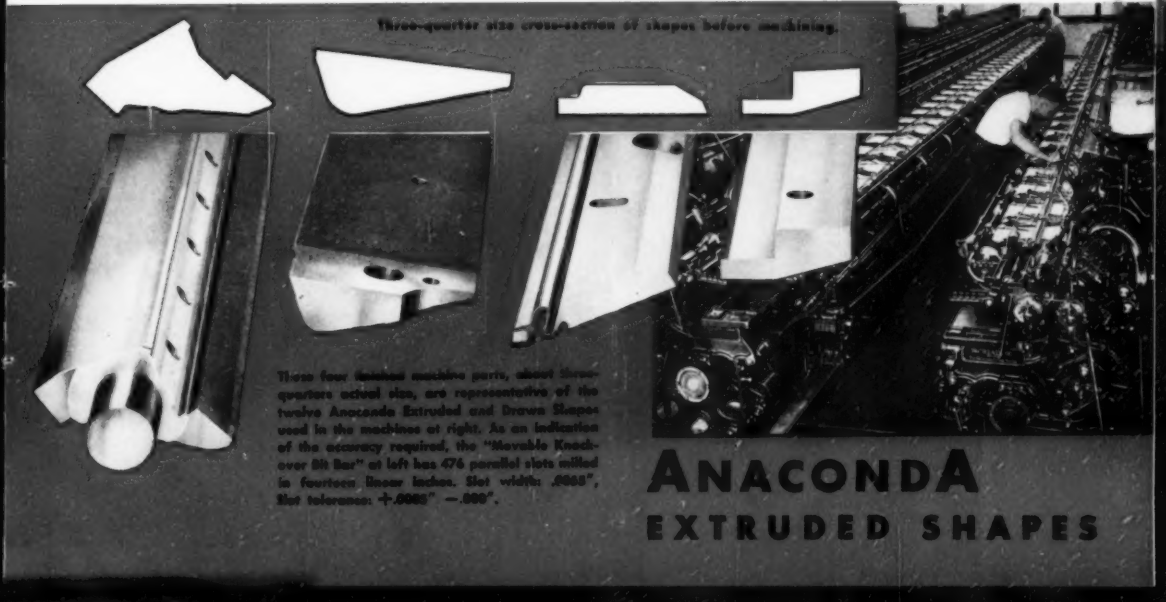

Three-quarter size cross-section of shapes before machining.
These four aluminum machine parts, about three-quarters actual size, are representative of the twelve Anaconda Extruded and Drawn Shapes used in the machines at right. As an indication of the accuracy required, the "Movable Knock-over Bit Bar" at left has 476 parallel slots milled in fourteen linear inches. Slot width: .0625", Slot tolerance: +.0005" —.000".
ANACONDA
EXTRUDED SHAPES

There's nothing skin-deep about the beauty of this lamp

Too bad we don't have X-ray eyes . . . we'd be spared the disappointment of learning, too late, that the things we thought were solid brass—are not.

Not so with the "China-Brass" lamp illustrated above. It's typical of the entire line of solid brass table lamps, floor lamps, and smokers made by the Oxford Metal Spinning Co., Inc. of Philadelphia, one of the country's foremost lamp designers and manufacturers.

As a purchaser, you'd be well pleased with its handcrafted beauty—the durability of its solid brass construction—and, of course, its moderate price.

As its manufacturer, you'd quickly recognize the economy of using solid brass for its metal components. For in this plant—which annually produces hundreds of *different* patterns, shapes, and designs—not a single stamping or drawing die can be found. Instead, coils of Anaconda Spinning Brass are sheared to squares, centerpunched, cut to circles, and spun by hand. In this way, several hundred duplicates of an original design can be completed before a toolmaker could get halfway through a set of dies. Savings are passed on to the customer.

Using brass of just the right composition, grain size and temper is an important part of this low-cost, high-quality program. That's why "Oxford" consistently specifies "Anaconda Brass"—made by The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

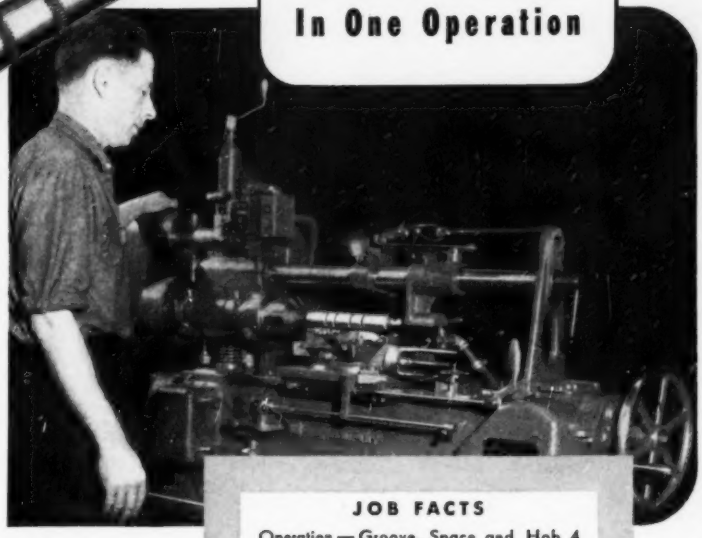
Discs of Anaconda Sheet Brass and cut-to-length sections of Anaconda Seamless Tubes are used exclusively in spinning the Oxford lamp components illustrated.

ANACONDA COPPER & BRASS

for unsurpassed uniformity

500% PRODUCTION INCREASE!

Locate, Groove and Hob 4 Positions on Shaft In One Operation



Using

SPECIAL FEED AND STOP ARRANGEMENT ON BARBER-COLMAN No. 6-10 HOBBING MACHINE

Special tooling on this Barber-Colman No. 6-10 Hobbing Machine has increased hourly output of these signal shafts from 2 to 12, an increase in production of 500%.

The vertical cam feed and special micrometer stop permit this piece to be located, grooved and hobbed in the four positions shown, all in one set-up. As one section is completed, cam-feed lifts the work, and the hob is manually relocated in the next section by the micrometer stop. This cycle repeats for each section to produce a total of 12 shafts per hour.

If you have work adaptable to the hobbing process, consult your Barber-Colman representative about extra equipment for converting standard machines to specialized jobs. The addition of special tooling often accounts for tremendous increase in production.

JOB FACTS

- Operation — Groove, Space and Hob 4 Sections on Shaft
- Equipment — B-C No. 6-10 Hobbing Machine equipped with extra Cam-Feed and Micrometer-Stop arrangement
- Production — 12 shafts per hour, an increase of 500%
- Accuracy — Sections spaced +.000/−.003″
- Hobs — B-C Shank Type, .100 C.P., ⅝″ dia. x 1½″ face; produces 100 pieces per sharpening

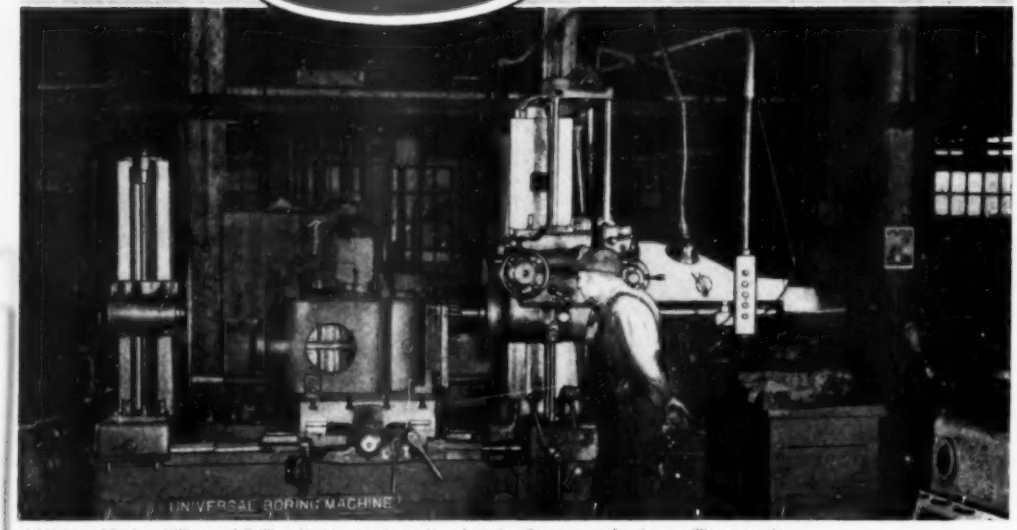
Barber-Colman Company

GENERAL OFFICES AND PLANT, 1145 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

SEND BLUEPRINTS

Submit specifications and prints for proposal on your special Hobbing Applications. No obligation, of course. Write for Bulletin No. 1145.

BULLARD



3" Universal Boring, Milling and Drilling Machine at Kinney Manufacturing Company performing a milling operation.

Wherever you go *Universal?* Sure, the Old Reliable

The older Universals have been good — have proved their worth. Bullard-Universals will carry on this tradition.

Now Bullard lends an added touch — with sound engineering and field experience, Bullard engineers are modernizing numerous operating details in keeping with modern metal working standards.

Bullard-Universals presently offer many advantages for efficient and safe operation:

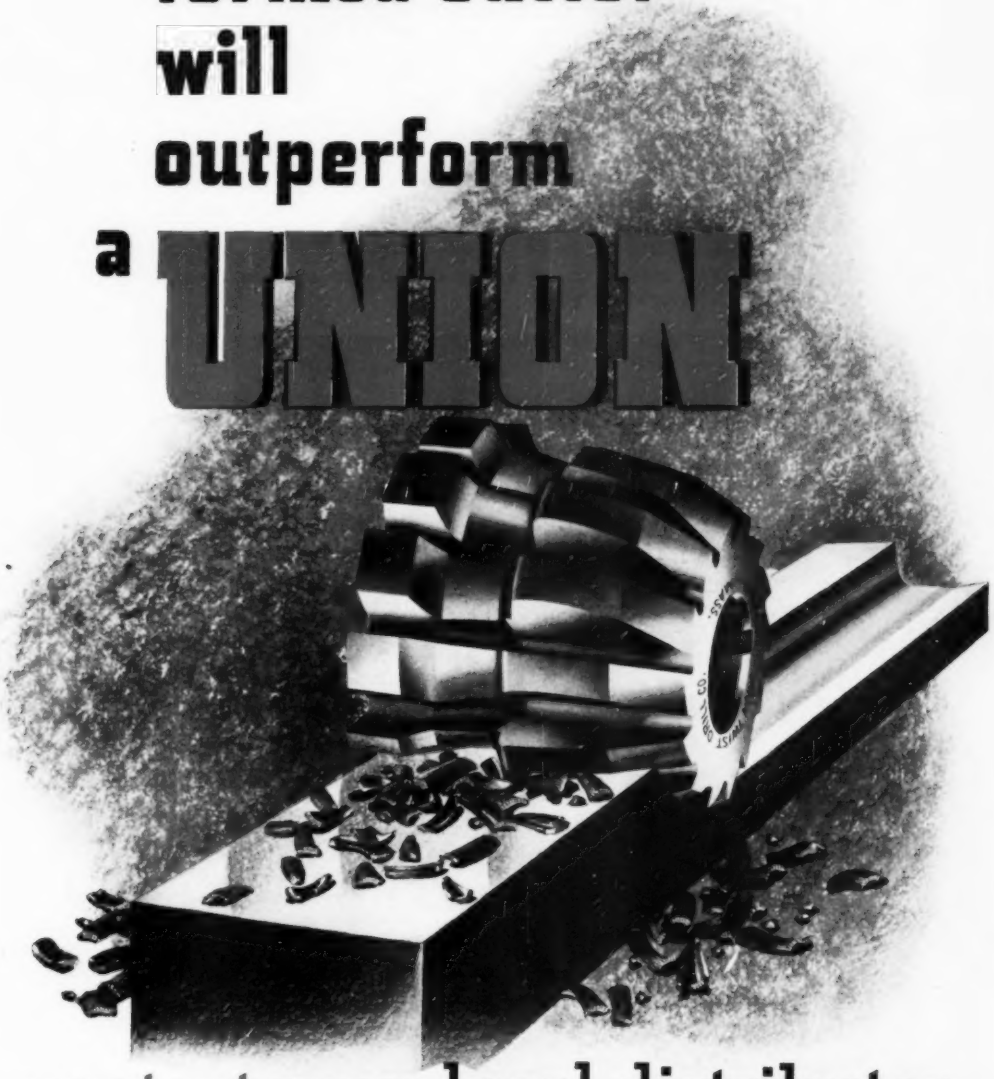
- **Efficient Hydrodynamic Drive providing Rapid Spindle reverse even at high speeds**
- **Safety Push Button Control**
- **Right Hand Controls**
- **Ease of selecting operating functions**
- **Wide range of capacities covering the 3" — 4" — and 5" spindle sizes.**

Note convenient Safety Pendant Control held by the operator.

Let Bullard quote on your requirements.

THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT

no other formed cutter will outperform a UNION



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His name is listed in Union's THOMAS' REGISTER insert under the heading "Drills, Twist".

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates.

BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers.

BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

Jones & Lamson

Ground Thread Chasers for 25 years!

FIRST and FINEST...

All models of Jones & Lamson RADIAL TYPE Automatic Opening Threading Dies are equipped with GROUND THREAD CHASERS. They are the ideal investment for general threading work involving relatively small lots and diversified pitches. They will lower your tooling inventory too, because standard chaser sets are immediately available from factory stock.

RADIAL DIE HEADS

VERSATILITY – Will cut right or left hand threads, coarse or fine pitch. Capacities from No. 8 to 4½".

STOCK REMOVAL – Unbeatable for coarse pitch, heavy duty threading such as Modified Square, 29° Acme, Worm or other threads.

STRENGTH – Every part is of solid steel, hardened and precision ground – no built-up sections.

FLOAT – All models are built with both eccentric and longitudinal float.

SIZE ADJUSTMENT – External micrometer adjusting screw for precise head setting to exact pitch diameter.

ROUGH & FINISH LEVER – Heavy roughing cuts, followed by light, accurate finishing cuts can be taken with the same set of chasers.

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JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U. S. A.

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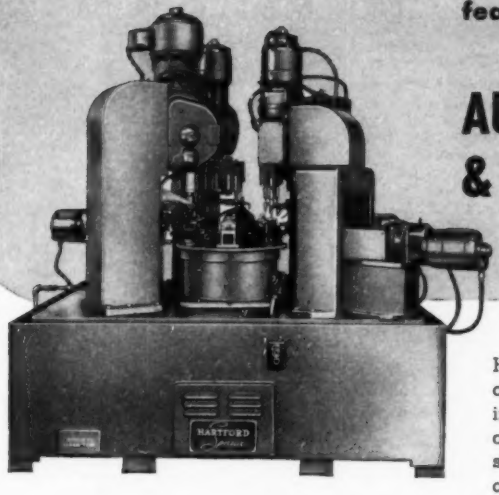
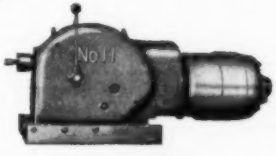
"LANGELIER"

AUTOMATIC DRILLING & TAPPING MACHINES



This machine does 15 facing, drilling, reaming and tapping operations on a small part. Multiple spindle heads are used on some drilling and tapping units to accomplish two or more operations at a station.

Automatic Unit
No. 11 & 31



Lead Screw
Tapping Unit
No. 12 & 22

The spindles of all units are of alloy steel, heat treated and ground, mounted in anti-friction bearings. All gears are of heat treated alloy steel. Dovetail adapter plate with screw adjustment permits quick and accurate positioning.

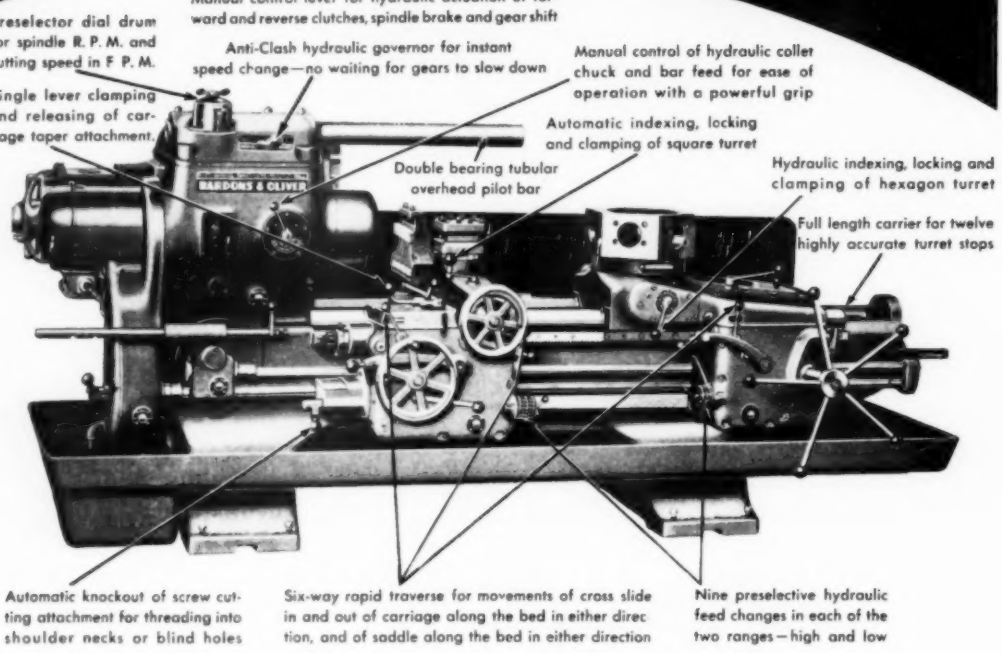
Hartford Special Drilling and Tapping Machines are scientifically engineered to do all the "thinking" necessary to produce the finished pieces on a specific job. The operator's part is reduced to starting and stopping the machine, and loading and unloading the parts. Since his skill is not a factor, the finished pieces are of uniform accuracy and the high production rate is automatically maintained. The sequence of operations such as drilling, tapping, counterboring, milling, reaming, spotting, chamfering etc., is designed to require the minimum of time, space and maintenance. If your job requires a special single-purpose machine, it will be worth your while to investigate the "packaged engineering" Hartford Special has to offer. Why not write our Engineering Department now. The Hartford Special Machinery Co., Hartford 5, Connecticut.

HARTFORD Special

...the standard for special machinery

PAYS LARGE DIVIDENDS THROUGH *Increased Production!*

The BARDONS & OLIVER No. 22 SADDLE TYPE TURRET LATHE is an Outstanding Investment for *Low Cost Production* of *High Quality Work*


Manual control lever for hydraulic actuation of forward and reverse clutches, spindle brake and gear shift
Preselector dial drum for spindle R. P. M. and cutting speed in F. P. M.
Anti-Clash hydraulic governor for instant speed change—no waiting for gears to slow down
Manual control of hydraulic collet chuck and bar feed for ease of operation with a powerful grip
Single lever clamping and releasing of carriage taper attachment
Automatic indexing, locking and clamping of square turret
Double bearing tubular overhead pilot bar
Hydraulic indexing, locking and clamping of hexagon turret
Full length carrier for twelve highly accurate turret stops
Automatic knockout of screw cutting attachment for threading into shoulder necks or blind holes
Six-way rapid traverse for movements of cross slide in and out of carriage along the bed in either direction, and of saddle along the bed in either direction
Nine preselective hydraulic feed changes in each of the two ranges—high and low

Note the combination of features listed above. This is exclusively Bardons & Oliver design, to be found in no other line of machine tools. Check the features against your needs for more efficient, lower cost production. Investigate the possibilities. Write us for full information.

BARDONS & OLIVER, INC.

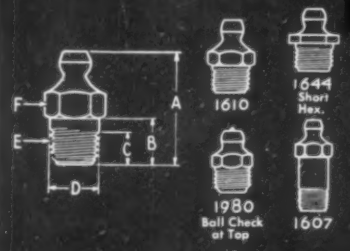
1133 WEST 9TH STREET • CLEVELAND 13, OHIO

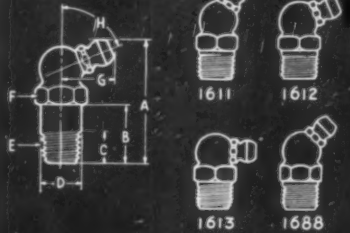
Genuine ALEMITE LUBRICATION FITTINGS

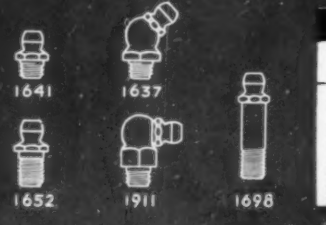
DATA SHEET NO. 1

Simplify ORDERING, INSPECTION and INVENTORY CONTROL. Specify Alemite part numbers on your blueprints.

Useful Information to Help You Select and Specify the Right Alemite Fitting for Every Bearing







STRAIGHT HYDRAULIC FITTINGS

Part No.	A	B	C	D	E†	F
1607	1 17/64"	25/32"	13/64"	13/32"	1/8" P.T.	7/16"
1610	31/32"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"
1618	1 7/64"	5/16"	1/4"	1/2"	1/8" P.T. (Female)	1/2"
1634	13/16"	5/16"	1/4"	13/32"	1/8" P.T.	7/16"
1644	21/32"	5/16"	1/4"	13/32"	1/8" P.T.	7/16"
*1650	57/64"	5/16"	19/64"	13/32"	1/8" N.P.T.F.	7/16"
1669	1 3/64"	1 17/64"	1/4"	13/32"	1/8" P.T.	7/16"
1684	2 5/8"	2 3/16"	5/16"	13/32"	1/8" P.T.	7/16"
*1708	53/64"	23/64"	19/64"	13/32"	1/8" N.P.T.F.	11/32"
1980	41/64"	17/64"	7/32"	13/32"	1/8" P.T.	7/16"

*Leak-proof seal
†Thread size listed as 1/8" P.T. is 1/8" P.T.F.—SAE EXTRA SHORT

1/8" THREAD ANGLE HYDRAULIC FITTINGS

Part No.	A	B	C	D	E†	F	G	H
1606	1 13/16"	1"	3/8"	13/32"	1/8" P.T.	7/16"	15/32"	90°
1611	1 1/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	21/64"	30°
1612	53/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	1/2"	67 1/2°
1613	49/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	33/64"	85°
1614	1 5/64"	5/16"	1/4"	13/32"	1/8" P.T.	7/16"	31/64"	105°
1620	1 5/16"	13/32"	5/16"	7/16"	1/8" P.T. (Female)	7/16"	17/32"	45°
1623	1 3/16"	9/16"	1/4"	13/32"	1/8" P.T.	7/16"	31/64"	67 1/2°
1638	2 9/32"	1"	3/8"	13/32"	1/8" P.T.	7/16"	21/64"	30°
1649	2 25/32"	2 3/16"	5/16"	13/32"	1/8" P.T.	7/16"	29/64"	67 1/2°
*1651	1"	7/8"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	1/2"	67 1/2°
1688	61/64"	17/64"	13/64"	25/64"	1/8" P.T.	7/16"	27/64"	45°
*1692	1 7/32"	7/8"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	21/64"	30°
*1693	15/16"	3/4"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	31/64"	90°
*1950	1 1/8"	3/4"	19/64"	13/32"	1/8" N.P.T.F.	7/16"	15/16"	105°

*Leak-proof seal. †Thread size listed as 1/8" P.T. is 1/8" P.T.F.—SAE EXTRA SHORT

1/4" PIPE THREAD HYDRAULIC FITTINGS

Part No.	A	B	C	D	E†	F	G	H
1627	33/64"	33/64"	9/16"	11/16"	1/4" P.T.	9/16"	.....	.....
1629	1"	11/16"	9/16"	11/16"	1/4" P.T.	9/16"	5/8"	67 1/2°
1691	1 21/64"	Female Thread			1/4" P.T.	5/8"	.....	.....

†Thread size listed as 1/4" P.T. is 1/4" P.T.F.—SAE EXTRA SHORT.

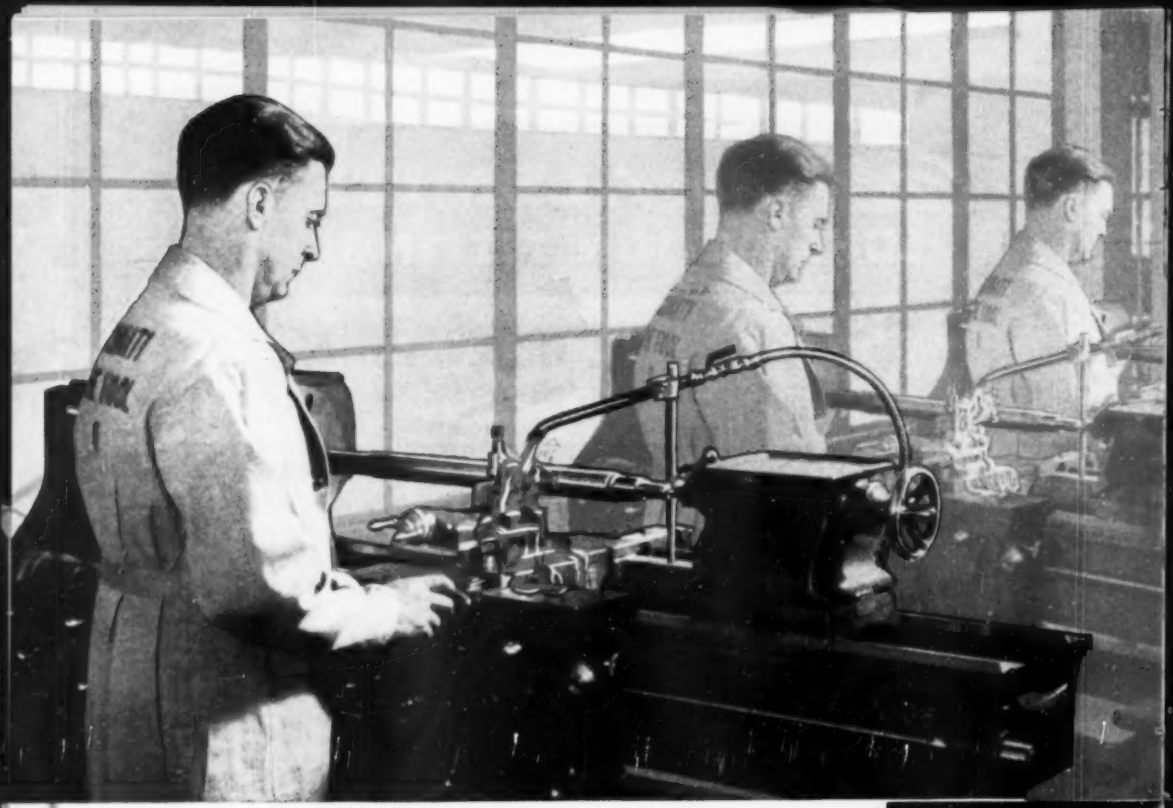
1/4"—28 THREAD HYDRAULIC FITTINGS

Part No.	A	B	C	D	E	F	G	H
1636	31/32"	19/64"	1/4"	17/64"	1/4"-28 Taper USF-Thd.	3/8"	3/8"	45°
1637	27/32"	11/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	3/8"	3/8"	45°
1641	31/64"	11/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	5/16"	.....	.....
1652	43/64"	23/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	5/16"	.....	.....
1680	59/64"	39/64"	1/4"	17/64"	1/4"-28 Taper USF-Thd.	5/16"	.....	.....
1698	1 7/64"	51/64"	1/4"	17/64"	1/4"-28 Taper USF-Thd.	17/64"	.....	.....
1703	1"	7/32"	3/16"	1/4"	1/4"-28 Taper USF-Thd.	17/64"	.....	.....
1770-A	19/32"	7/32"	7/64"	1/4"	1/4"-28 NF-2-Thd.	1/8"	25/64"	45°
1792	31/64"	9/64"	1/8"	1/4"	1/4"-28 NF-2-Thd.	17/64"	.....	.....
1911	47/64"	11/64"	1/4"	1/4"	1/4"-28 Taper USF-Thd.	3/8"	15/32"	90°

ALEMITE
Modern Lubrication Methods That Cut Production Costs

FREE—Reprints for engineers, draftsmen, and all plant men. You may obtain a complete set of these data sheets covering all Alemite Fittings. Simply write to Alemite, 1899 Diversey Parkway, Chicago 14, Illinois.

Another Product of STEWART WARNER



Operators see PINK... and love it

THE PINK they see is Cimcool,° the revolutionary cutting fluid that makes the working picture a lot rosier. For Cimcool isn't subject to rancidity and objectionable odors. It's a *chemical emulsion*. Can't burn. Can't smoke. Has no unpleasant odor of its own.

And there are more reasons why operators prefer the job with Cimcool in the machines. Cimcool is clean to work with, doesn't soil hands or clothes. Leaves no hazardous slippery film on hands, machine, work or floor. Contains no skin irritants. And Cimcool cools so fast that tools and chips actually stay cool to the touch. You'll get better production when operators see pink—see CIMCOOL on the job.

Write for free booklet, "CIMCOOL Gives the Answers." Address, Sales Manager CIMCOOL Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for 85%
OF ALL METAL CUTTING JOBS

USERS *Recommend Highly*

Our 75TH Year
CINCINNATI BICKFORD
1874-1949
METAL DRILLING MACHINERY
SUPER SERVICE

Equal Efficiency of Every Unit Makes the Balanced Machine

We have proven conclusively in our shop that this new SUPER SERVICE Precision Drilling Machine, when used with an automatic spacing table, saves money, time and labor by eliminating jigs, bushings and fixtures. This 36-speed, 18-feed, 10 HP Machine is well recommended. This typical statement was made by a user of one of these new machines:

> "The SUPER SERVICE Precision Drilling Machine is the best investment we have made for a long time. It is performing way beyond our expectations as to drilling time, precision work and overall savings."

Let us show you how your jobs can be economically processed on one of these machines.

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

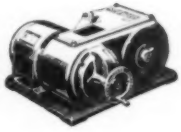
"...499 suggestions for Reeves Speed Control and one for television in the locker rooms."

THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 10 hp.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



The benefits of REEVES Speed Control, applied to your production machines, will be immediately apparent to everyone in your organization. Management will see it in production, sales and financial reports. The man at the machine will see it in the almost effortless ease with which he turns out *more and better work.* For the right speed for every operation and every operator under every changing operating condition, install REEVES Variable Speed Drives and Controls on your present machines . . . demand them on the new machines you buy. Write for full details on the complete REEVES line. Ask for the new, 132-page Catalog No. A25-3N.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE
Reeves Speed Control
GIVES THE RIGHT SPEED FOR EVERY JOB!

SPOT NEWS OF METALWORKING

Cold extruding of 105-mm high-explosive shell bodies is being done by Mullins Mfg. Corp., with only three machining operations — one on the rotating band and the other two boring and threading the nose. Of a 26-lb slug, only 1.2 lb is scrap.

Polished steel parts, without being oiled, are being shipped to users in wood crates lined with vapor-phase inhibitor (V.P.I.) treated paper which protects them from rust for more than a year. Tests have shown such parts unrusted and ready for use after passing through the tropics.

A pay-out-of-savings plan, Treasury approved, is accounting for 21% of his current sales, one large manufacturer of metalworking equipment says.

Capital-goods manufacture has increased in New England since the war more than enough to offset the loss in consumer-goods industries. Metalworking now is the number one industry, with electrical machinery the fastest-growing single factor in number of jobs.

Production costs per unit have declined this year in a New England metalworking company, despite a cut of 30% in working force and a shifting-around of jobs among employees retained. Reason: greater effort by individual workers to do a day's work as jobs get scarcer.

Beta gage for measuring thickness of lacquer on beer cans and of tin plate on steel is latest development in the isotope tracer field.

By combined hydraulic and mechanical principles, one aircraft manufacturer is forming sheet-metal parts to tolerances of 0.002 in. without wrinkles or springback and at costs lower than conventional methods.

To abrasive-blast small castings in quantity, one company has installed a 15x16x7¼-ft rubber-lined room with two blast nozzles in the ceiling. A power-driven car on rails has a 10-ft revolving table which is loaded outside, then pushed into the room. A friction wheel at the rear of the room rotates the table at 4-13 rpm during blasting.

To avoid moving parts in a heat-treating furnace, one company has designed a horizontal furnace with inclined through channel. Small parts are fed to this channel by hopper, then move through the furnace by periodic vibration of the channel.

Titanium may eventually replace steel as cladding on Army tanks. Army Ordnance is now making extensive tests of the new metal. Tank armor of titanium would be roughly half the weight of the present steel plate, and even more resistant to penetration. Object is a tank tough enough for battle yet light enough to be air-lifted. (See story p. 225)

A non-aggression pact has been signed by CIO auto workers and the International Association of Machinists. Each union has agreed not to poach on bargaining rights of the other in any plant. The left-wing CIO electrical workers, victim of heavy raiding by its sister CIO auto union, asks why it isn't entitled to the same consideration.

Copper-base alloy castings using permanent molds will be produced by a new company being formed here. The process is expected to compete with brass sand castings, die castings, forgings, and investment castings where excellent finish and precision without high cost is desired.

Gaging Metalworking

Metalworking production has not yet been seriously affected by the Steel strike. Incoming orders in many segments of the industry are up compared with September. Output is at least as good as then and perhaps somewhat better.

It is not likely that the impact of the steel shutdown will be felt much until well into November. Many users have fortified themselves with enough tonnage to run much longer. On the other hand, the fear is that a shortage of a minor item may compel some shops to close which otherwise could stay open.

The strike is increasing steel costs for some consumers who are forced to buy from warehouses in the emergency instead of getting tonnage direct from the mills.

Index Rises Four Points

The AMERICAN MACHINIST index rose five points in September to 205, with 1939 taken as 100. What is more, a gain was scored in all five segments which comprise the index. Seasonal improvement was only partially responsible for the upturn. The automotive segment stood at 247, against 244 in August. Electrical manufacturing jumped four points, from 192 to 196. Industrial machinery went up two points.

► It is believed that the October index figure, based on manhours worked, will be as high as September's, with possibility of a slight rise.

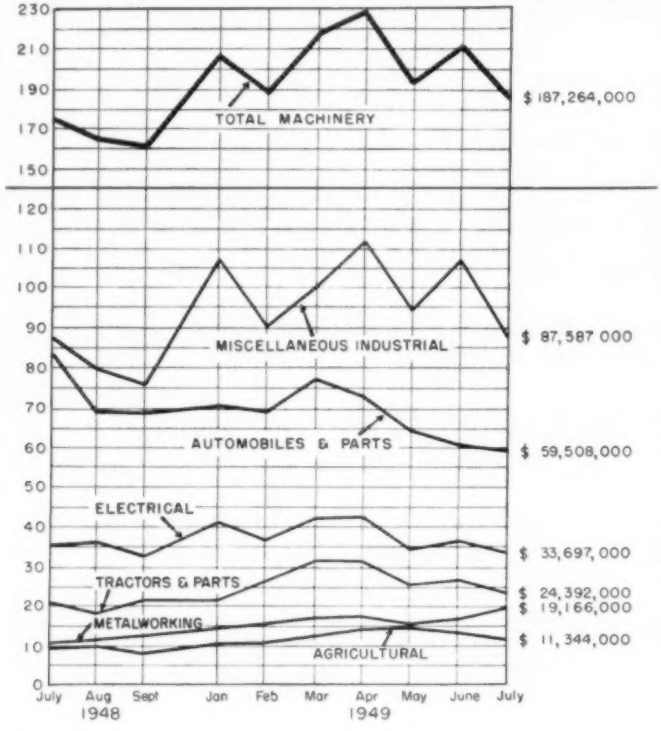
Tool Business Picks Up

Machine tool business picked up in September. New orders were about 10% higher than in the previous month. October is estimated to have stayed at the September level or to have risen slightly.

Shipments meanwhile continued during September and October at the August rate and have exceeded sales by a considerable margin. Backlogs have been eaten into, as a result. They provide the industry with a scant three months' business. However, these bookings are not well distributed and many builders badly need orders to keep going more than a few weeks.

► Export business continues to loom importantly, despite devaluation. A further check on the ECA program confirms the belief that western Europe will take sizable numbers of machine tools in the months ahead. ECA countries are likely to need and place orders for $75 million of U.S. machine tools in fiscal 1950, though delivered prices to buyers in those countries have gone up considerably.

Metalworking Machinery Exports Rise While Other Equipment Drops



1951 Auto Tooling Promising

Automotive tooling for 1951 models gives greatest promise of all the domestic markets for machine tools.

Orders for machines for a projected aircraft jet engine are in the making. Should the program go through, the machine tools involved will be placed by parts manufacturers who will be subcontractors to the company building the engine itself.

Wright Field has taken bids on machine tools for maintenance work on jet engines and shortly will purchase the equipment. Certain types of grinding machines required will total around $400,000.

It now appears that machine tool shipments this year will not exceed $240 million. That compares with $285 million in 1948 and establishes a new postwar low mark. New orders for the year will total $230-$240 million.

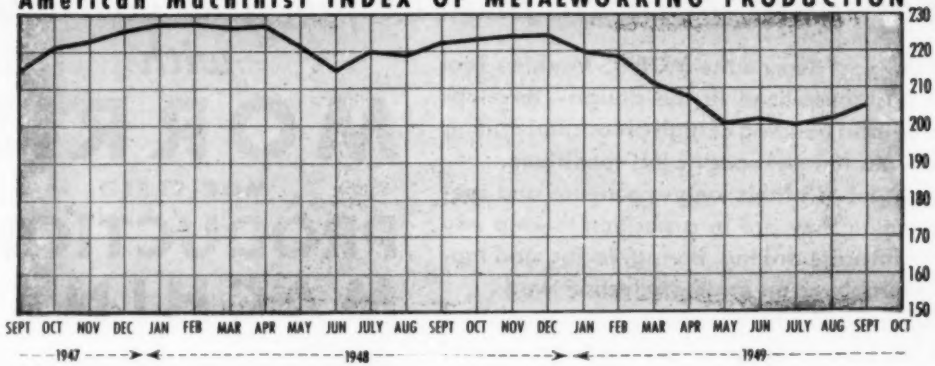
Textile Machinery Doing Well

Textile machinery builders are doing very well. One company reports operations at full capacity with enough orders on hand and assured ahead to continue at current rate well into 1950.

A second company states that business is good and should stay good through the first half of next year. Another builder says that new orders have dipped since midyear, but the first half was better than the comparable period of 1948.

Still another textile machinery company declares that its business this year will be ahead of 1948, but present production is off from the level maintained earlier in the year. Prospects for next January to June are fairly good.

American Machinist INDEX OF METALWORKING PRODUCTION



INDEX		COMPONENTS				
		MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANS-PORTATION EQUIP.	OTHER METAL-WORKING
Sept. 1949 (preliminary)	205	194	196	247	291	136
Aug. 1949	201	192	192	244	288	135
Sept. 1948	222	249	231	227	308	154

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

A considerable portion of textile machinery demand stems from foreign countries. Builders do not seem much disturbed by the possible effects of devaluation. They have been getting almost all export business on the basis of superior quality rather than price.

Cutting Tool Sales Improve

Some betterment is reported in sales of cutting tools. July was the low spot for the year. Since then the order curve has gone up slowly but steadily. The steel strike, if it persists, will slow down demand in November.

A variety of electrical goods has been doing well. Turbines, switch gears, transformers and electric controls are being turned out at a big rate. Production of meters has been stepped up as utility companies cleaned out inventories and consumer demand increased.

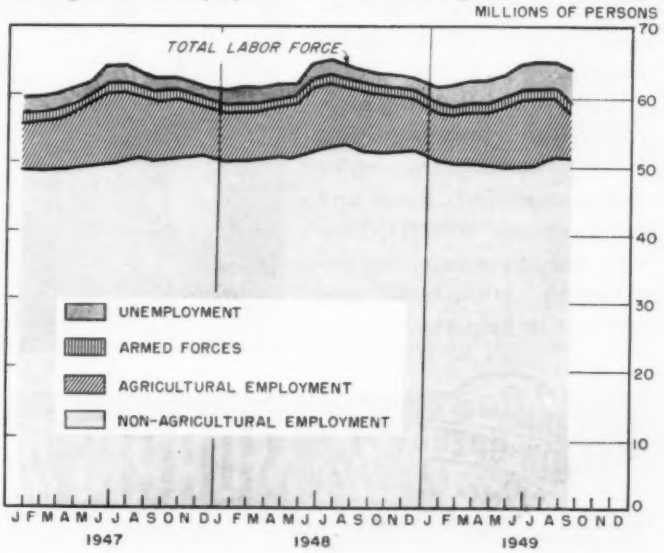
Output of electric motors of all sizes is up. Large and medium size motors have done better all year than fractional horsepower motors which were hard hit by curtailment of production in household appliances. The fractional motor sales, however, have jumped sharply as a result of the resurgence of business in household appliances.

Steel To Run at High Level

The steel strike has its encouraging aspects. Though it temporarily may put a damper on operations, steel mills will be compelled to run at or near full capacity for months to catch up on orders. In short, the prospect is that the steel industry and many steel fabricators will go through the winter at a very high level, once the strike is settled.

What happens to steel prices depends on the strike outcome, but talk that they will go down has stopped. The decline in prices in general has slowed down. Prices of fuels and textile products, among others, are firming. Food may drop a bit more seasonally. Construction costs, on the other hand, have turned upward slightly as a result of wage increases and higher materials prices.

Non-Agricultural Employment at 64 Million, Higher Than Year Ago



You gain both in production and cost-wise with

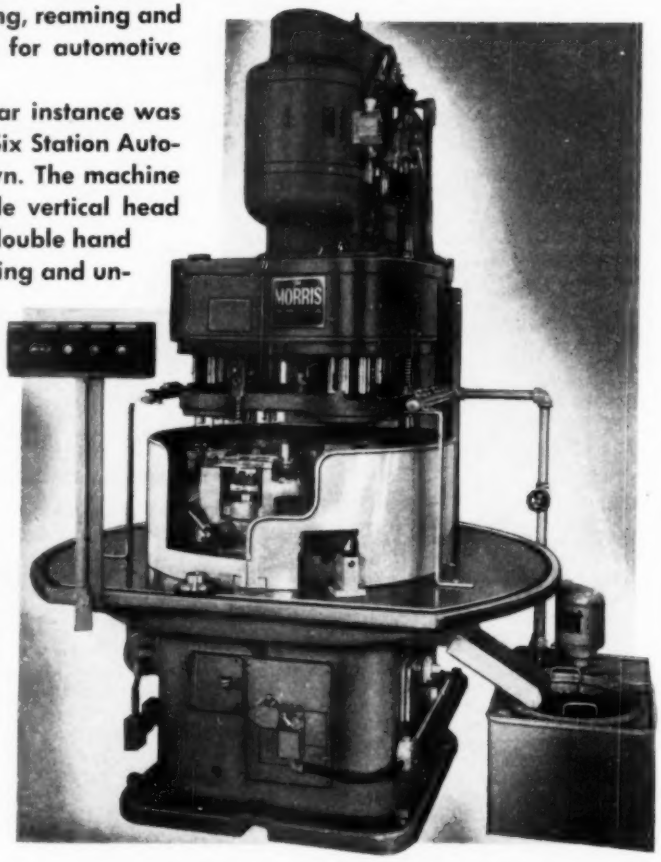
MORRIS
MOR-SPEED
PRODUCTION MACHINE•

For the past decade the MORRIS Machine Tool Co. has specialized in the design—development—and building of high production drilling machines to meet specific job conditions.

As a result of this long experience and specialization they are in a position to help you solve intricate drilling, boring, facing and tapping problems on mass production work.

Take the machine illustrated for example:—the job here consisted of drilling, reaming and chamfering steel pump hubs for automotive transmissions.

The answer in this particular instance was the Morris Vertical Hydraulic Six Station Automatic Indexing machine shown. The machine is equipped with a 28 spindle vertical head and six fixtures arranged for double hand loading with automatic clamping and unclamping. A coolant system flushes the work during machining operations.



Production is continuous and averages over 1700 pieces per eight hour day. The operator merely loads and unloads the work at the loading position.

If you are considering high production work requiring drilling, reaming, tapping or similar operations, it will pay you to consult MORRIS. They have the experience, the engineering "know-how" and facilities to help you.

Builders of MOR-SPEED Line

The MORRIS Machine Tool Co.
CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Time to Replace the Old

Are we heading down the road toward technological stagnation as the British did?

We might well ask ourselves that question after examining the results of American Machinist's Mid-Century Inventory of Metalworking Equipment. Facts and figures turned up by this Inventory occupy the next 96 pages in this issue.

The Inventory provides convincing proof that we are headed in the wrong direction. Instead of gaining ground since V-J Day, we have lost it. We are worse off now than in 1945.

It isn't just the knowledge that we have a higher ratio of machines 10 years old or older that is so disconcerting. It is the fact that in another five years, by 1955, over three out of four machine tools in the nation's metalworking plants will be at least 10 years of age.

And even now, we have in operation in our metalworking industries more machines over 20 years old than ever before in history. More than one out of every five is in that unenviable class. The record in metal-forming equipment is even worse.

What a shameful situation! America, the land of mass production, the land of mechanical skill unmatched elsewhere in the world. America, the arsenal of democracy in wartime, and supposedly the leader in industrial know-how and performance in peacetime.

Yet it permits its physical machinery to deteriorate dangerously. In an era of high costs, of intensive competition, of squeezed profit margins, it lets its production tools get out of date and inefficient.

In the months and the years of the cold war, it appears indifferent as its machine tools and other production equipment rapidly grow older.

At a time when feelings are running high in Washington about whether we will be better off with B-36's or more aircraft carriers, when new planes and guns and self-propelled missiles are commanding attention, few if any words are voiced in protest or alarm as more of the machinery which produces those weapons becomes obsolete.

Despite the depressing evidence turned up by the Inventory, the situation is not hopeless. It is a challenge to each metalworking company to better its own condition; and it is an opportunity for every builder of machine tools and other production equipment to go out and do a selling job.

This is the day of cost-cutting in industry. It is the day when every intelligent manufacturer should be reaching out for every means to increase the productivity per manhour in his plant. It is the day when penny-saving as well as dollar-saving counts.

It should be a field day for equipment makers with postwar-designed products which make it unprofitable for their customers to keep their old machines.

To be sure, helpful tax depreciation legislation is needed in Washington. And there are many other factors which could help put industry in a better frame of mind about tossing out old equipment in favor of new.

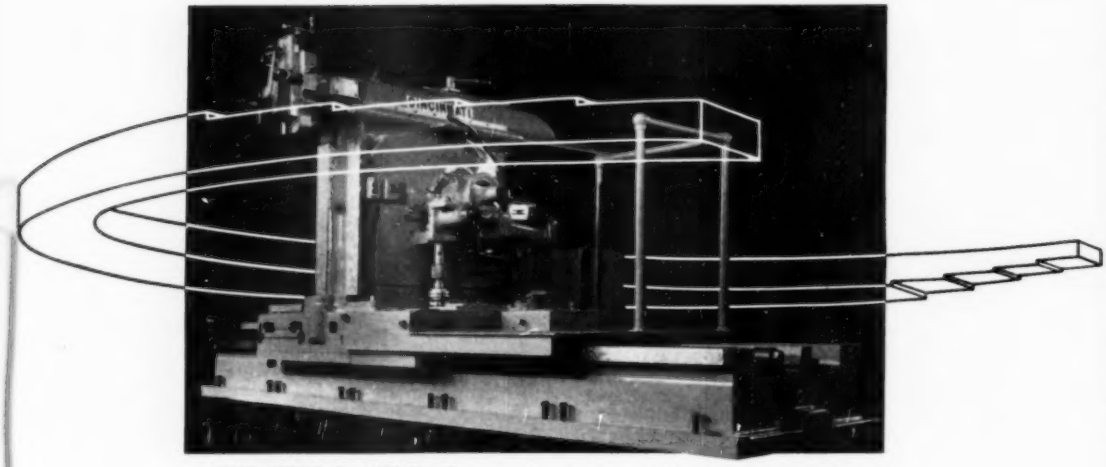
But nothing will do the trick as fast as for equipment builders themselves to prove to the nation's metalworking manufacturers that they just can't afford to keep that old stuff around.

Burnham Finney

EDITOR

8 ft. OF CROSS FEED

ON THIS CINCINNATI SHAPER



ONE SETUP SAVES TIME. Seven feet at end of 20-foot diameter cast steel generator half rings is machined with one setup as shown in schematic sketch above.

NEW! This new Cincinnati Traveling Shaper accurately machines surfaces requiring eight feet of table travel—with one setup.

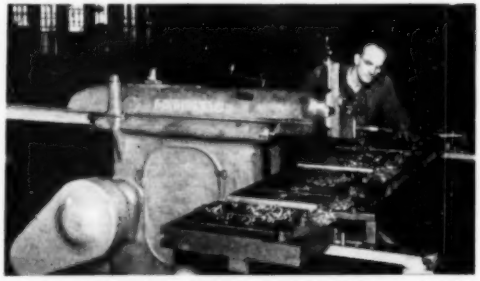
The operator rides with the machine so controls are always at hand. Accurate settings can be made easily at any point of travel with the vernier.

NEW ECONOMIES! This Cincinnati Traveling Shaper is effecting real economies for a large manufacturer of motor generators.

Steps are machined over a seven-foot length on the ends of seven-ton generator rings 20 feet in diameter. This one setup greatly reduces machining time on this otherwise awkward job.

NEW FIELDS! This application of powerful Cincinnati Shapers opens up new fields of use in the machining of long, interrupted surfaces on very large work.

Investigate the possibilities for you in this new Shaper development. Our Engineering Department will be glad to cooperate.



MANY APPLICATIONS, such as shaping slots in eight-foot table, are performed quickly and economically with a Cincinnati Traveling Shaper.

Write for the new Shaper Catalog—S-5.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

CINCINNATI

INDUSTRY SEEKS WAYS TO CUT COSTS

Industrialist Cites Search for Cost-Cutting Methods

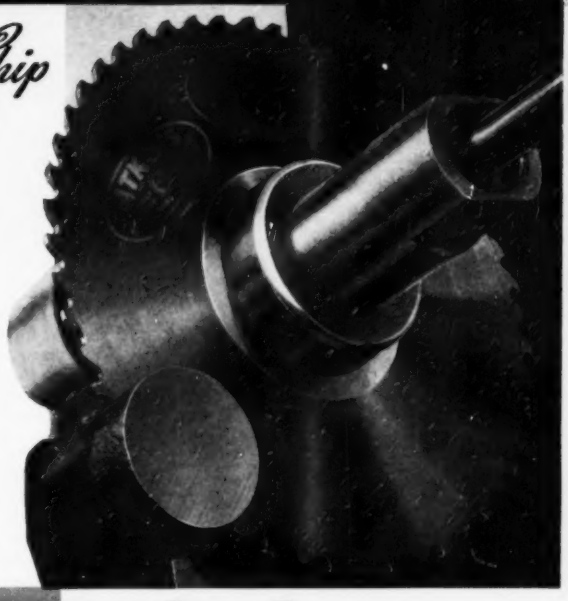
Here's One Way . . . REDUCE MILLING COSTS!

ATKINS *Curled-Chip* MILLING SAWS

increase cutting production . . . minimize re-machining and saw replacement costs

Because of their greater tooth strength and "Curled-Chip" tooth face, Atkins Milling Saws allow heavier feeds and faster cutting speeds. The *inward-curving* Atkins "Curled-Chip" tooth gets *under* the chip and *lifts* it in a smooth, self-ejecting coil. There is less heat and no feed chatter. Chips are carried free of the cut; tooth breakage is practically eliminated. Cutting periods between grindings are greatly lengthened. The total result is truer cuts that need less re-machining—sharply lowered saw replacement and servicing costs.

Arrange to have an Atkins Cutting Engineer demonstrate Atkins "Curled-Chip" Milling Saws. This is your first step to important savings. Call in your Industrial Distributor today!



ATKINS *Curled-Chip* SEGMENTAL SAWS

The saws that keep heavy-duty cutting on a rock-bottom economy basis. The "Curled-Chip" tooth form reduces horsepower required per unit of metal removed, eliminates chips jamming in the cut, permits narrower cutting widths. Worn-out teeth can be quickly replaced without discarding the saw. All sizes, 11 inches to 10 feet in diameter.

ATKINS

"*Silver Steel*" SAWS

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AAA TRADE MARK ATKINS "ATKINS ALWAYS AHEAD"

MAKERS OF BETTER SAWS FOR EVERY CUTTING JOB

Can You Grind One Engine Block PER MINUTE?

BLANCHARD 16-A2 GRINDS TRACTOR CYLINDER BLOCKS CONTINUOUSLY

Here is a good example of mass grinding of larger pieces at a greater profit.

A four station mechanical clamping fixture, designed and built by Blanchard, continuously rotating on the 55" diameter chuck of a No. 16-A2 Blanchard Surface Grinder, presents the Engine Blocks to the grinding wheels.

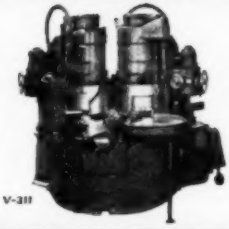
The material is cast iron and .010" of stock is removed from each surface—*to a flatness of .0015".* Production is 60 pieces per hour including loading and unloading time.

If you have larger engine cylinder blocks to grind, the Blanchard 22-A, with proper number of spindles, will do the job. Let Blanchard show you how.

PUT IT ON THE BLANCHARD

Whatever type of flat surface machining your parts may require—simple "cleaning up," rough grind and finish grind in one operation, or very flat surfaces with fine finish and held to close limits—there is no more profitable method, in most cases, than to "Put it on the Blanchard."

If you machine flat surfaces . . . bring your problems to Blanchard engineers.



BLANCHARD

The **BLANCHARD** MACHINE COMPANY

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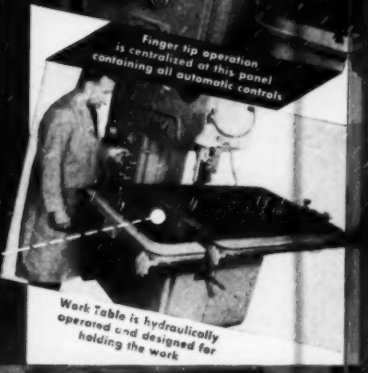
MANUFACTURING MACHINE TOOL

THE NEW *Contour-matic...*

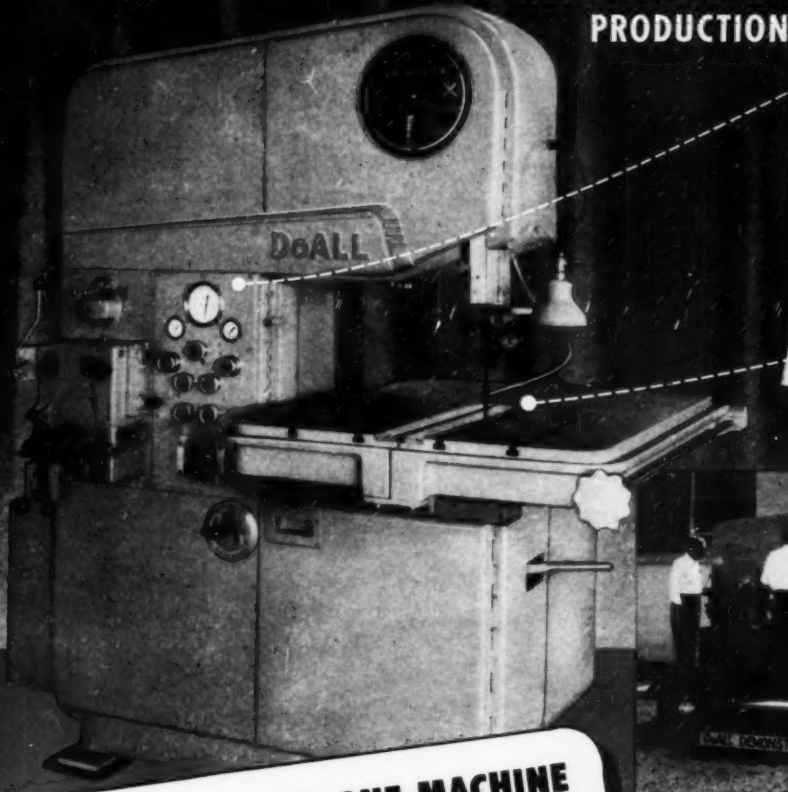
HAS **55** NEW FEATURES
IN ITS ADVANCE DESIGN
FOR FASTER PRECISION
PRODUCTION

Complete speed range from 40 to 10,000 f.p.m. to cut all materials most efficiently



Finger tip operation is centralized at this panel containing all automatic controls

Work Table is hydraulically operated and designed for holding the work



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Cut every METAL!

PLUS ANY OTHER SOLID MATERIAL

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Let us demonstrate proof of profitable economy in your own plant with these specially constructed trailer units

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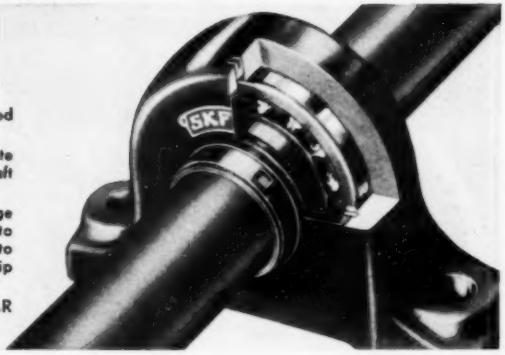
The SKF SUA unit pillow block

its DESCRIPTION



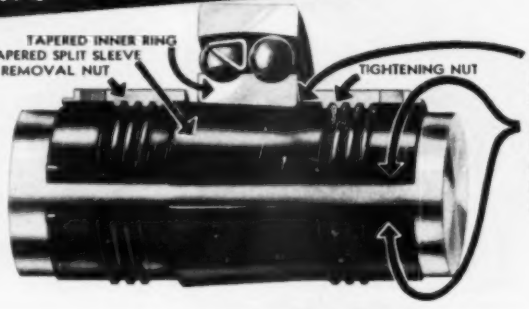
To maintain a *tight fit* between bearing and shaft, you need an SKF SUA unit pillow block.

It's completely assembled, lubricated and ready for immediate use. Available in "free" and "held" types . . . and in shaft sizes from 1 7/16" to 2 7/16".

Its SKF-exclusive Align-O-Seals prevent lubricant leakage and dirt intrusion. No exposed bearing . . . no lock screws to raise troublesome burrs on the shaft . . . for the nut is locked to the sleeve. Even though the shaft vibrates, the concentric grip will not loosen.

Designated as type SUA with ball bearings—and type SUAR with spherical roller bearings.

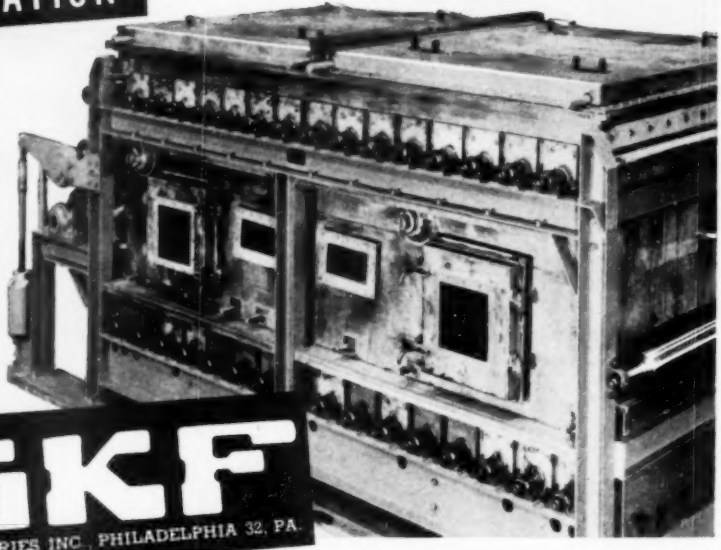
its CONSTRUCTION



TIGHT FIT results when the tightening nut pushes the tapered inner ring over the tapered split sleeve.

CONCENTRIC GRIP is firm and positive—as the split sleeve contracts and wraps around the shaft. Removal is accomplished by reversing the process—with tightening nut loosened, removal nut pushes inner ring off the sleeve.

its APPLICATION



THE GREENVILLE STEEL AND FOUNDRY COMPANY of Greenville, S. C., specified SKF SUA units and built a "tight fit between bearings and shafts" into this DuPont Steamer for piece goods drying.

64 SKF SUA 107 unit pillow blocks help maintain long-range dependability on this unit which operates at 150 yards per minute maximum. Our engineers can show you why the SKF SUA unit pillow block belongs in your specifications. Write today.

6600

SKF

INDUSTRIES INC., PHILADELPHIA 32, PA.

SPRINGFIELD

announces

its *New* Model S,

The

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GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

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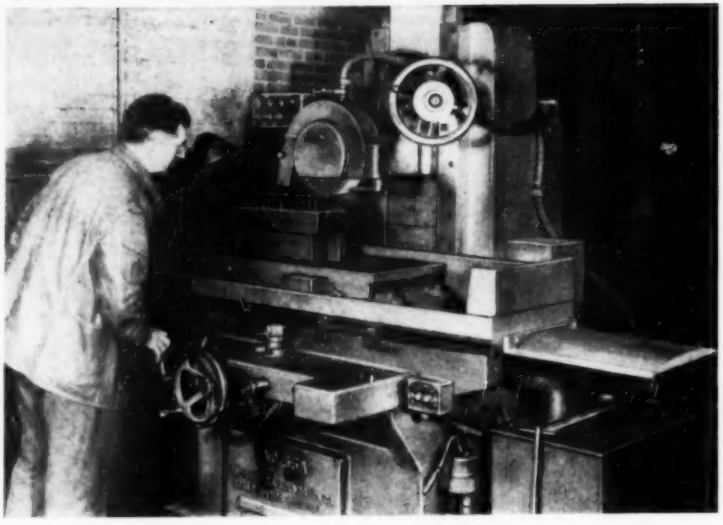
Enthusiastic Customers do our BEST advertising



True Temper Corporation, manufacturers of True Temper Products, use fourteen Grand Rapids Hydraulic Feed surface Grinders in ten of their factories. The machine shown is a 55A.

You will appreciate the micro-inch finish produced at production speeds on Grand Rapids Grinders. All Grand Rapids Hydraulic Feed Surface Grinders have these outstanding features:

1. **One-piece column and base casting for vibrationless rigidity**
2. **Precision ball-bearing spindle which is greased for life**
3. **Bijur one-shot lubrication system eliminating hand oiling**
4. **Patented vertical movement of wheel head for quick, accurate adjustments**
5. **Portable coolant tank for ease of coolant replacement**
6. **Vane type hydraulic pump for fast longitudinal table travel**

to serve you—

Your inquiry concerning your specific grinding needs will receive prompt attention. Grand Rapids Grinders include: Hydraulic Feed Surface Grinders, Universal Cutter and Tool Grinders, Hand Feed Surface Grinders, Drill Grinders, Tap Grinders, and Combination Tap and Drill Grinders.

GALLMEYER & LIVINGSTON COMPANY

330 Straight, S. W., Grand Rapids 4, Mich.

GRAND RAPIDS GRINDERS

EXPERT, DEPENDABLE, CONVENIENT
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Typical Allis-Chalmers Certified Service Shop — Electric Apparatus Repair Company, Philadelphia— is equipped for big emergency jobs ...gives fast, personalized service on every day maintenance and repair.

WHEREVER your plant is located — from Boston to San Diego — you can get prompt, skillful motor repair service from a nearby Allis-Chalmers Certified Service Shop. These shops, selected for their reliability and excellent repair facilities, now cover every major industrial area in the country.

When you need work done on motors, transformers or control — when you're looking for a shop that can help you cut lost production hours and get you rolling again, fast—call the A-C Certified Service shop nearest you.

These shops are hand-picked from the best independent shops in your locality. They meet exacting A-C standards — use factory-approved methods and parts to assure like-new motor performance.

Need Repairs? New Motors?

For expert service — for new motors from ½ to 25,000 hp — give your nearest A-C Authorized Dealer or Sales Office a call!

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CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

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Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Slash cut-off

FOR MAINTENANCE AND UTILITY WORK

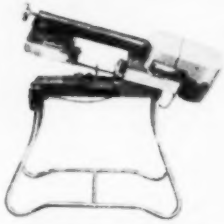
HERE'S WHY WELLS BAND SAWING WILL SAVE YOU MONEY—

- ★ **Fast, continuous cutting action**
- ★ **Greater accuracy on each job**
- ★ **More pieces from each bar**
- ★ **Automatic stock projection**

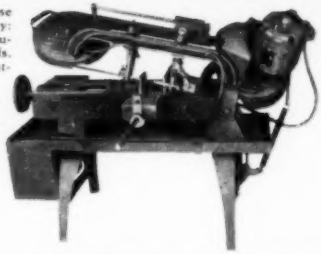
IN today's tightening cost competition Wells Metal Cutting Band Saws are paying off better than ever. By utilizing the modern band sawing principle, Wells Saw users have found they can reduce cut-off time by as much as two-thirds. The band saw blade removes a minimum of stock. In production cutting this adds up fast—more pieces from each length of material. Accurate cutting and material savings are also big factors in slashing cut-off costs.

Wells Saws can be used virtually anywhere on most shapes and materials. Standard models are available to handle a wide range of jobs. Special Wells Saws are designed and supplied for unusual requirements. Wet cutting systems, which permit higher f.p.m. cutting speeds and increase blade efficiency, are available for most models.

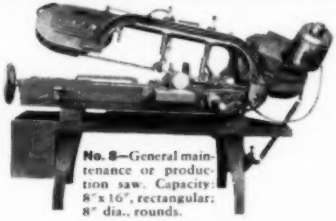
Put yourself in a position to slash your cut-off costs by contacting your Wells Dealer or writing for literature today.



Model 49A—Portability plus Stability. The saw of 101 uses. Capacity: 3½" x 6⅝", rectangular; 5½" dia., rounds.



No. 5—All purpose utility saw. Capacity: 5" x 10", rectangular; 5" dia., rounds. Shown with wet cutting system.



No. 8—General maintenance or production saw. Capacity: 8"x 16", rectangular; 8" dia., rounds.

Wells SAWS

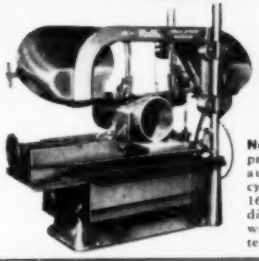
THE SIGN OF SERVICE

Wells

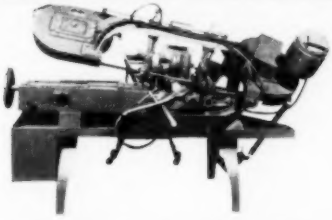
costs!

with WELLS METAL CUTTING BAND SAWS

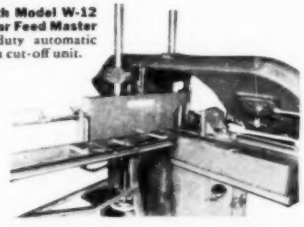
FOR PRODUCTION JOBS



No. 12—Heavy duty production saw with automatic cutting cycle. Capacity: 12" x 16", rectangular; 12¾" dia., rounds. Shown with wet cutting system.

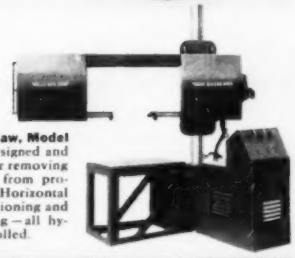


No. 8 with Model WJK Wells-O-Bar Feed Master—Medium sized automatic production cut-off unit.

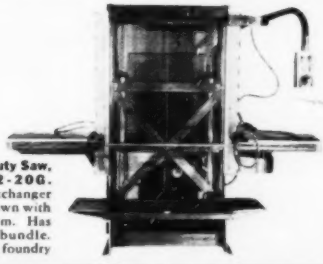


No. 12 with Model W-12 Wells-O-Bar Feed Master—Heavy duty automatic production cut-off unit.

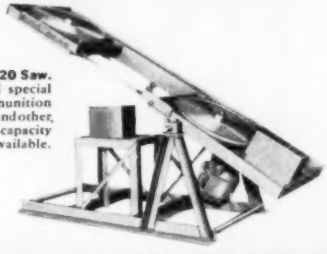
FOR SPECIAL APPLICATIONS



Special Radial Saw, Model No. 12-20R. Designed and built by Wells for removing gates and risers from propeller castings. Horizontal and vertical positioning and automatic feeding—all hydraulically controlled.



Special Heavy-Duty Saw, Model No. 12-20G. For cutting heat exchanger tube bundles. Shown with wet cutting system. Has capacity for 48" bundle. Also being used in foundry applications.



Special Model No. 20 Saw. Used on large and special jobs in ship yards, munition factories, foundries and other industries. Standard capacity—24". Other sizes available.

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION

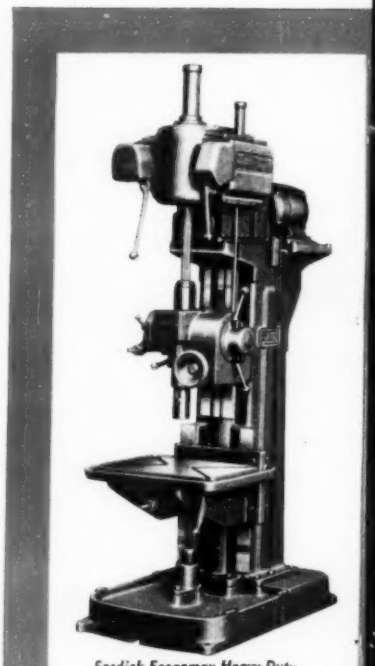
505 Oakland Avenue, Three Rivers, Michigan

IF YOU HAVE MACHINES AS OLD AS THESE, THEY SHOULD HAVE BEEN *Pensioned* YEARS AGO.....

Now you

● In their day the various FOSDICK Drilling Machines shown on this page were meeting the production demands and tolerances required at that time. But today, even though they are still in operation they are no match for the modern machines when you compare the low costs—productive capacity—reduction in maintenance—and ease of operation now available in FOSDICK machines. Replacing antiquated equipment is a must if you are to compete favorably in today's market.

1. Fosdick Upright Drill as furnished during the early nineteen hundreds.
2. An early model of the new, popular Fosdick Sensitive Radial.
3. The Fosdick Heavy Duty Radial patented in April 1922.



Fosdick Economax Heavy Duty Upright Drill

The FOSDICK

need modern FOSDICK MACHINES

TO COMPETE IN TODAY'S MARKET

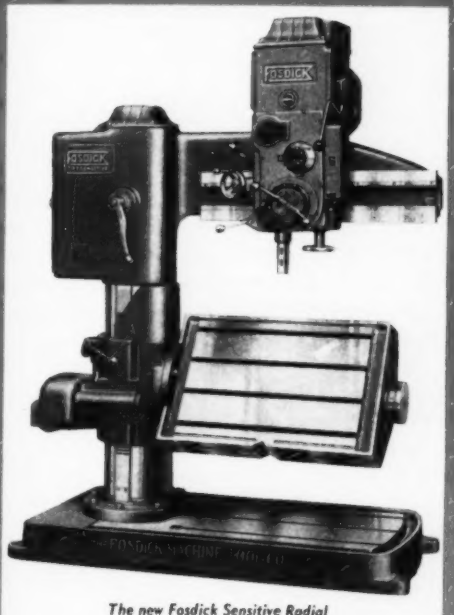
● For example the Heavy Duty Upright is of heavier more rigid construction, has 12 spindle speeds from 60 to 1500 R.P.M., hardened gears sprayed with oil, anti-friction bearings, standard electric motors, 9 feeds .005 to .043 inch per revolution, compound table, jig borer spindle for precision boring and tapping reverse.

The Sensitive Radial is of entirely new design, with heavier construction throughout. Notice the one piece columns construction of 12 inch diameter—fixed arm which swings 360°—adjustable table which swings 360°—tilting or standard type table which can be positioned to suit any drilling job—fast traverse to head—power or hand traverse for table—nine spindle speeds, ranges from 60 to 1200 to 175 to 3500 R.P.M.—four spindle feeds, 2 ranges .004 to .020 or .002 to .010 inch—tool ejector—patented semi automatic tapping—fluorescent tube on arm illuminates entire table.

The new Economax Hydraulic Radial features many outstanding operating advantages such as—hydraulic column clamp—hydraulic arm clamp interlocked with single lever control for unclamping and raising and lowering arm—hydraulic safety nut—hydraulic variable rapid traverse—hydraulic interlock for head and column when engaging feed—hardened steel ways—tool ejector—36 spindle feeds—18 feeds—and patented electric light at any position of head.

For a quick resume of the entire line of Fosdick Machine Tools write for our new bulletin—"The FOSDICK Line" F.L.A.

Fosdick Economax Hydraulic Radial



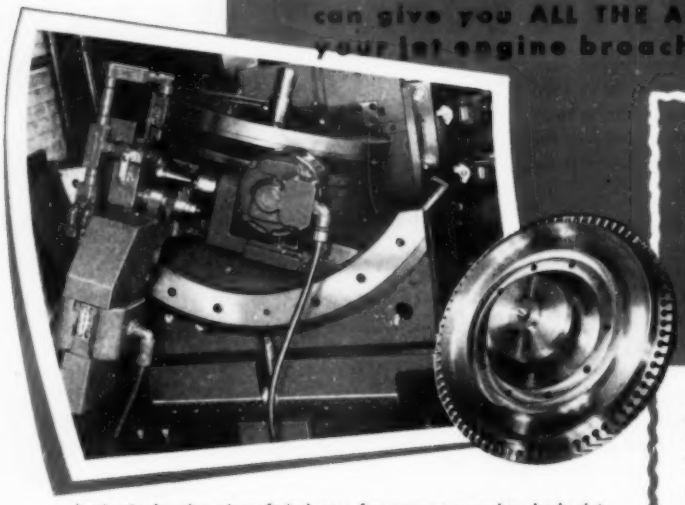
The new Fosdick Sensitive Radial

MACHINE TOOL COMPANY, *Cincinnati 23, Ohio*

LAPOINTE

UNIVERSAL FIXTURES

can give you ALL THE ANGLES to solve your jet engine broaching problems!

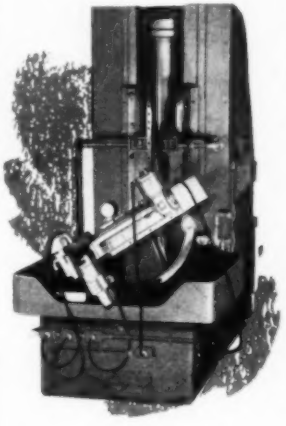


THE "HEART" OF JET ENGINE BROACHING

By the use of change gears, any number of slots can be cut, and at any required angle.

Since there are fourteen different stator segments that are broached on the Lapointe SRV Broaching Machine, the number of equidistant slots and the angle at which they are cut vary greatly.

The Lapointe Universal Fixture eliminates the difficult, time-consuming methods formerly required for holding the work. Now, with this protractor type fixture, a piece can be held in horizontal position or at any angle up to 48 degrees.



Instinctively, the aircraft industry for many years has looked to Lapointe for the most advanced engineering ideas on broaching. This is natural, for Lapointe not only pioneered broaching as an economical machining method but has always led the way in *driving down broaching costs.*

Take these universal fixtures, for example. Designed for holding the large compressor rotors *at compound angles,* they have greatly simplified the entire broaching procedure. Using the sine bar principle, the new Lapointe fixture replaces 12 fixed angle blocks formerly required — thus saving much valuable time when changing from one rotor to another.

Lapointe universal broaching fixtures make it easy for you to develop your ideas as you go along. In jet engine design, where improved efficiency is the constant aim, these universal fixtures are a major asset in helping you to achieve the maximum thrust and the ultimate in power . . . visible indications of an *efficient engine.*

It pleases us that so many of America's large and small production plants are saying: "Lapointe's the way to *better* broaching!" Write for our special folder describing the Lapointe Single Ram Vertical Broaching Machine. Ask for Bulletin SRV– 2.

THE *Lapointe* MACHINE TOOL COMPANY

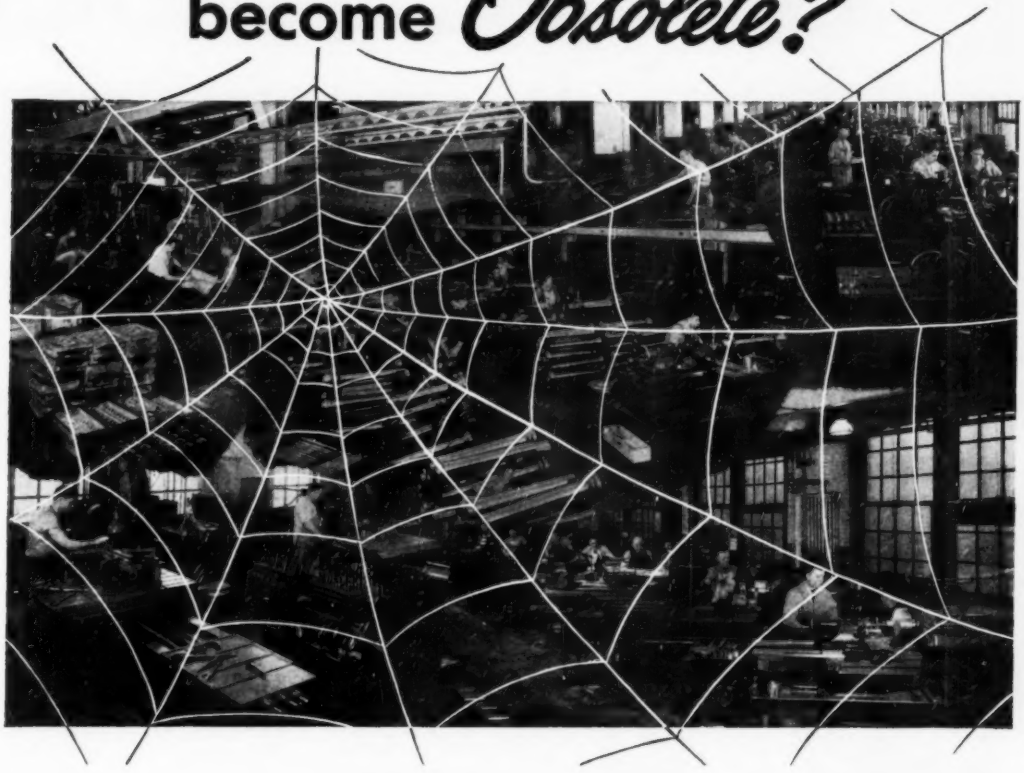
HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory • Edgware • Middlesex • England

HUDSON LAPOINTE MASS.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

When does a machine tool become *Obsolete?*



Age does not determine machine tool obsolescence!

Many machines, old in years, may still serve adequately for some jobs and under certain economic conditions.

However, if you are heading into the future with machine tools that are not so productive as those of your competitor, you have machine obsolescence—for **a machine tool becomes obsolete the minute your competitor starts using a better machine tool for the same purpose.**

Machine tools which have become obsolete—whether you bought them in 1925 or 1945—are a handicap which will be reflected in your next year's financial report.

Your Warner & Swasey Field Representative can show you how some of your turning and threading production can be improved. Often your Warner & Swasey representative can suggest accessories or new tooling setups which can make your present machines measure up to new designs.

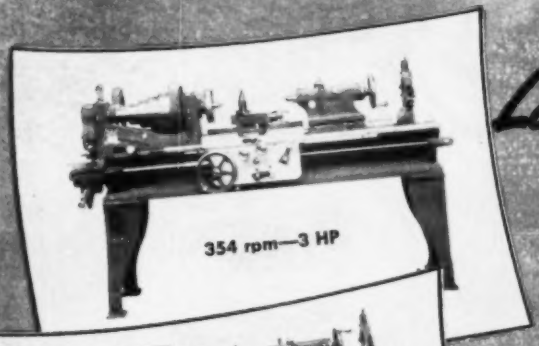
Warner & Swasey has only one thing to sell you—increased production!

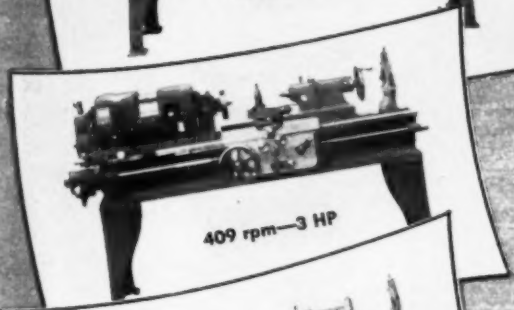
You can machine it Better, Faster, for Less... with a Warner & Swasey

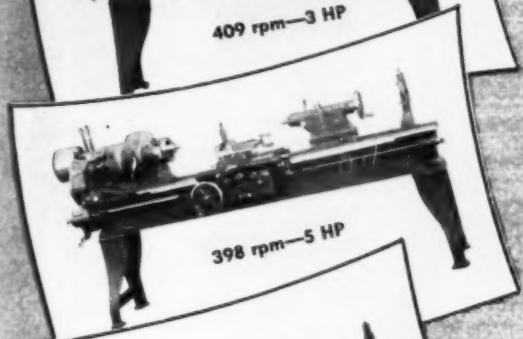
WARNER & SWASEY
Machine Tools
Cleveland

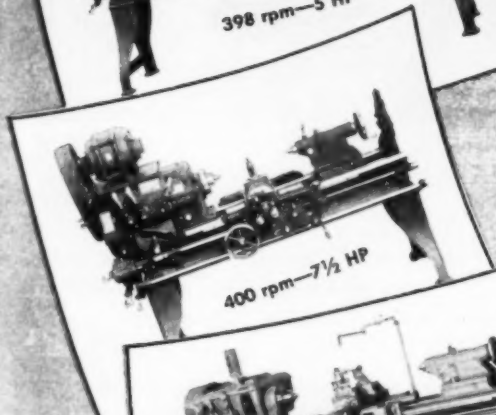
TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

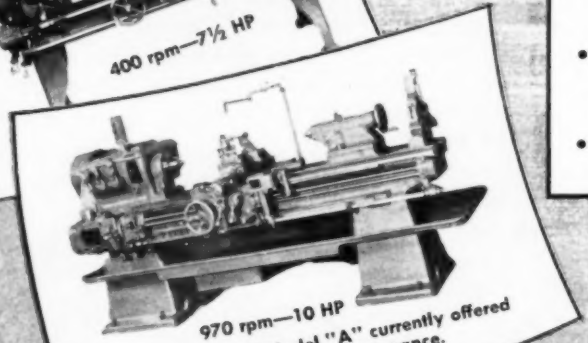
1892-1949 Lodge & Shipley GREATER HIGHER











Through the Years...

NOTABLE LODGE & SHIPLEY LATHE ADVANCEMENTS

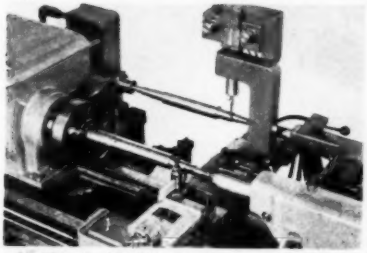
- **1894**—Quick change feed gears.
- **1900**—Double back geared headstock.
- **1905**—Single pulley patent head.
- **1907**—Multiple length and diameter stops.
- **1918**—"Selective Head" all-geared headstock with alloy steel gears and anti-friction bearings.
- **1929**—Improved feed gearing providing accurate metric and English translating gears and separate leadscrew and feed rod.
- **1935**—Advanced design bed with flat and dovetail bedways—24-speed headstock — dial-operated totally enclosed quick change gear box.
- **1946**—Hardened steel bedways 2000 r.p.m. headstock with 3-bearing spindle mounting and separate reservoir lubrication.
- **1948**—"Copymatic" hydraulic tracer control.

Illustrations show the Lodge & Shipley 16" lathe from its inception (top left) to the latest 1949 model (bottom right).

constantly provides....

HORSEPOWER TOP SPEEDS

for MORE production at LOWER cost!

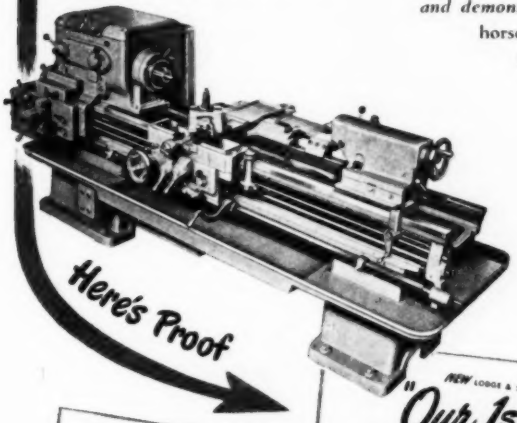


With the COPYMATIC attachment, offering instant changeover to automatic tracer controlled duplication, the Model "X" reaches even greater heights of profitable production.

Year after year, Lodge & Shipley has provided industry with notable improvements in lathe output and accuracy. Latest and greatest, according to Lodge & Shipley customers, is the Model "X" Engine Lathe, offering a variety of profit features, including 24-speed Selective Headstock with speeds up to 2000 rpm at 20 HP; other sizes up to 30 HP; hardened and ground steel bedways and exclusive Lodge & Shipley dovetail shape; exclusive slide rule calculator for instant selection of rpm; totally enclosed quick change gear box and full automatic lubrication.

In every way, the Model "X" Lathe outproduces lathes even a few years old. A Lodge & Shipley Representative will explain *and demonstrate*, on your own work, what higher speeds, greater horsepower and lasting accuracy can mean in your production. Write for Catalog No. 679-T.

THE **Lodge & Shipley** COMPANY
MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO



"OUTPUT INCREASED as high as 100%"
"Higher degree of accuracy"
"More versatility"
NEW LODGE & SHIPLEY COPYMATIC
"Our 1st choice"
"30% TIME SAVER"
Our 1st choice ON TOUGHEST JOBS"
Our 1st choice for MORE ACCURACY"
Our 1st choice for MORE USEFUL FEATURES"
TURNING TIME CUT 1/2
NEW LODGE & SHIPLEY COPYMATIC

ARMSTRONG

ARMSTRONG TOOL HOLDERS

answer both . . .

1. **The problem of lowering costs**
2. **The problem of increasing output**

By providing permanent, multi-purpose, inexpensive ARMSTRONG TOOL HOLDERS that use cutters or bits that are quickly ground from standard high speed shapes (Saving: All Forging, 70% Grinding and 90% High Speed Steel), the Armstrong System of Tool Holders will reduce your tool cost to an absolute minimum.

By providing stronger, more efficient tools, carefully developed for each operation, as well as ARMSTRONG High Speed Steel, ARMALOY Cast Alloy Cutter Bits or Armide Carbide-Tipped Cutters as required for each job, ARMSTRONG TOOL HOLDERS permit greatly increased speeds and feeds, enable you to increase the hourly output of every lathe, planer, slotter, shaper, turret lathe and screw machine.

There is no surer way to lower costs and increase output, than to use the correct ARMSTRONG TOOL HOLDER for each operation on all machines.

Stocked by Leading Tool Departments

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

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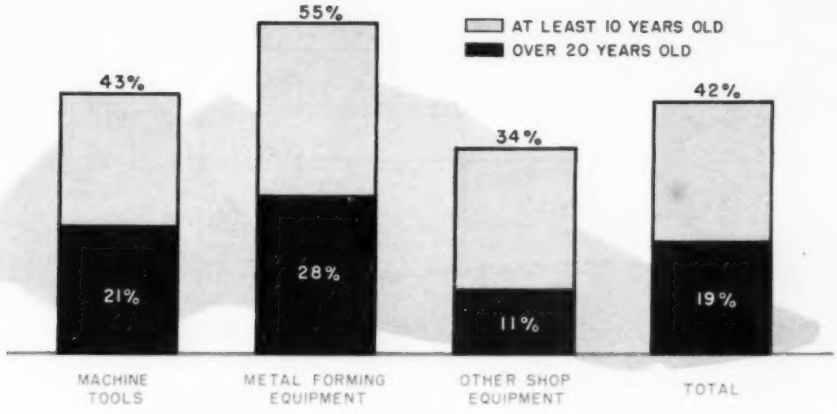
New York and San Francisco

Write for New S-48 Catalog just released.



AMERICAN MACHINIST Mid-Century Inventory of Metalworking Equipment Shows

OBSOLESCENCE TREND SHARPLY UP

AMERICA'S metalworking production equipment is in worse shape today than it was at the end of World War II.

The obsolescence trend of the 1930's toward a higher average age of equipment is back. The metalworking industries are falling behind in keeping their machinery up to date.

What is worse, more than one out of every five machine tools is more than 20 years old. That is, some 379,000 machines installed in metalworking plants are of 1928 design or earlier and were built during that period. These machines have had an average of a quarter century of use, including five years of wartime overwork and mistreatment.

If the present trend of inadequate replacement of old machines is not reversed, by 1955 more than three out of four machine tools in this country will be at least 10 years old.

These unpleasant and disconcerting conclusions are drawn from AMERICAN MACHINIST'S Mid-Century Inventory of Metalworking Equipment, just completed. The Inventory divides machine tools and other production equipment into three age classes: (1) units under 10 years old, (2) units 10 to 20 years old, and (3) units over 20 years old.

The situation is even more critical than the figures reveal. That is because hundreds of thousands of machine tools which technically are within the "less-than-10-year-old" category have been subjected to such hard usage that for all practical purposes they should be in a higher age group. They were run round-the-clock during war days, were operated by hastily trained workers and are of 1939, or earlier, design.

A detailed analysis of the Inventory and tables showing distribution of equipment by industries, areas, and types of equipment will be found on the following 95 pages. Special studies of government-owned machines, college shop equipment, and machinery in maintenance shops are included to complete the picture of America's metalworking resources.

ALPHABETICAL INDEX TO TABLES . . . PAGE 141

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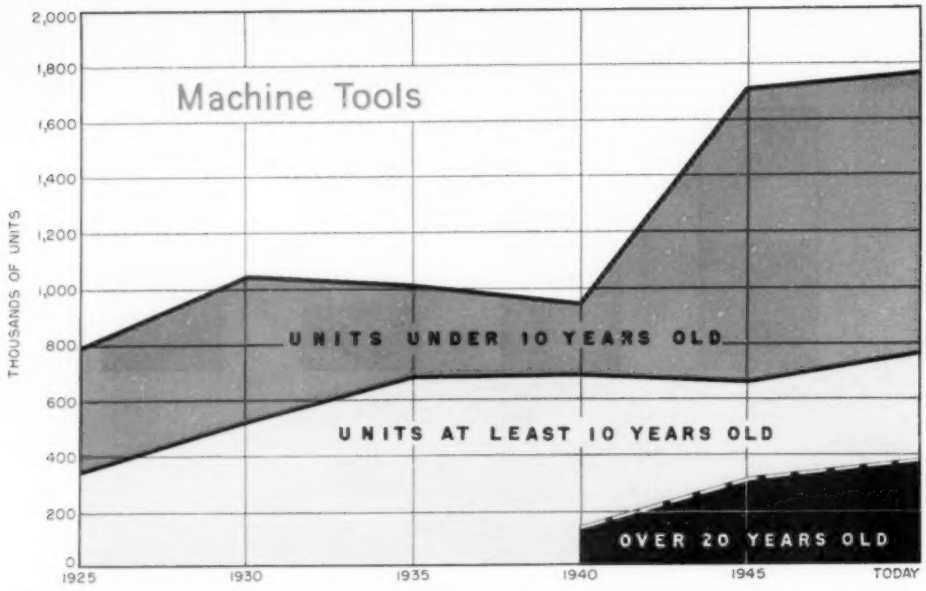


A QUARTER CENTURY OF AMERICAN MACHINIST INVENTORIES REVEALS . . .

METALWORKING HAS MORE OLD

THE NUMBER of machine tools at least 10 years old installed in American metalworking plants is at an all-time high—759,000 units. The same is true of metal forming equipment, with 260,132 units 10 years old or older.

It is probable that the 301,864 units of "other shop equipment" at least 10 years of age represents a new peak, too. Exact comparison with previous Inventories unfortunately is not possible in this category. They did not provide the broad coverage of the Mid-Century Inventory.

Altogether, a total of 1,321,047 units of metalworking equipment (grouping all three of the above categories) is 10 years of age or older. This equipment has suffered from hard usage, has been outmoded by new technical developments, and represents inefficient and high-cost manufacturing practices.

Here are some of the highlights from the Inventory's conclusions:

1. Over 43% of the nation's machine tools today are 10 years old or older. That compares with 38% in 1945.

2. More than 800,000 machine tools less than 10 years of age are of prewar design. Some of these designs date from the early 1930's.

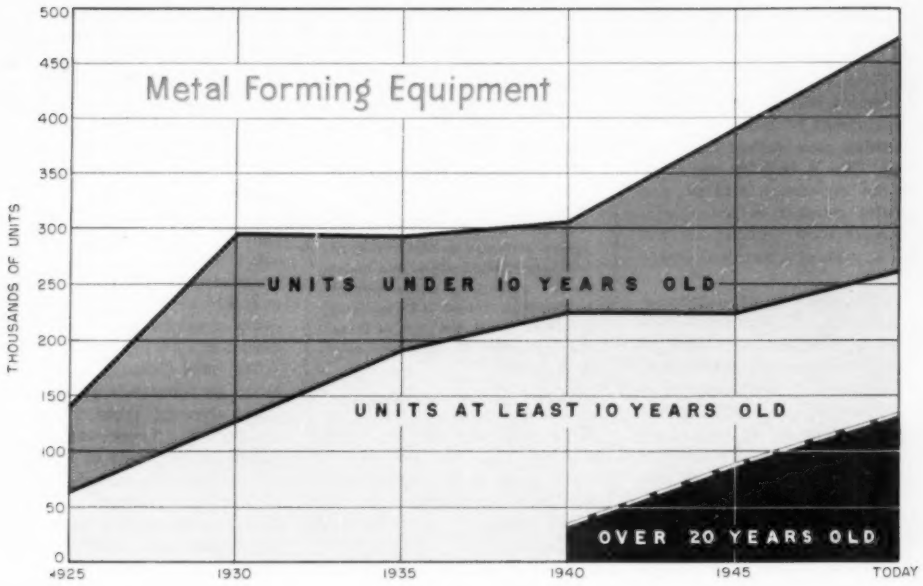
• MACHINE TOOL PRODUCTION PROVIDES CHECK ON

A DOUBLE-CHECK on the accuracy of the Mid-Century Inventory can be made by comparing the results with machine-tool production. Machine-tool shipments from 1940 to 1944 inclusive were reported by Tools Div., WPB at 1,004,000 units. Exports during this period are estimated at 212,200. Thus a total of 792,000 units went into plants in this country.

From the beginning of 1945 to July 1, 1949 (the midpoint for collection of data for the Mid-Century Inventory) machine-tool shipments as reported by NMTBA were 286,564 units. Exports during this period are reported at 55,833 units, leaving 230,731 in the United States. If we estimate shipments from plants not reported by NMTBA during this period at about 70,000 units, the total would be 300,000 units.

Imports during the entire period from 1940 to July 1, 1949 are estimated at 5,000 units. In addition, several thousand machine tools have been built in the nation's toolrooms. No accurate data are available, but the practice was probably more widespread during the machine-tool shortage of World War II than it normally is.

If we assume that 15,000 homemade special machines were built



EQUIPMENT TODAY THAN EVER BEFORE

3. At least 95% of the machine tools in use today are more than 10 years old in design.

4. The metalworking industries today have 1,762,165 machine tools installed in their shops. That is an all-time high and is 51,000 more units than the total reported in 1945.

5. The remarkable postwar developments in machine tools—greater power, higher feeds and speeds, automatic cycles and tracer controls, automatic work handling—are being scantily used. Last year the new machine tools produced and installed were only 2% of those in active operation, altogether too few for a prosperous, competitive economy.

6. Metal forming equipment, which totals 471,257 units, has a larger ratio of old machines than machine tools. Over 55% is at least 10 years old; 28% is more than 20 years old.

All of these facts add up to this point: there has been a critical lack of modernization since the war in the metalworking industries. Many reasons for the dangerously low replacement rate may be offered. High taxes; bad tax depreciation policy by the federal government; uncertainty about labor and other government legis-

ACCURACY OF THE MID-CENTURY INVENTORY •

during this period, this figure plus imports plus domestic production less exports, gives an estimated total of 1,112,000 machine tools less than 10 years old.

The Inventory reports 1,003,000 machine tools less than 10 years old. To this must be added the reserve tools, and those in maintenance and college shops that fall in this age group. From the special studies made in conjunction with the Inventory, these are estimated at 32,000, 71,500, and 5,000 respectively. This gives a total of 1,111,500 machine tools less than 10 years old.

Although a number of these figures are of necessity only estimates, they have been made from the best available government and industry data. The close approximation of the totals (1,111,500 and 1,112,000) provides a check on the accuracy of the basic methods use in making this Inventory.

According to the 1945 and Mid-Century Inventories, there was a net increase of 51,028 machine tools during the intervening period. The difference between this figure and the 300,000 new machines installed is represented, of course, by old machines either scrapped or sold outside metalworking for maintenance or other operations.

lation; restrictive labor practices encouraged by unions; these are some of the factors.

But the basic fact remains that the nation's metalworking production equipment is deteriorating at an alarming rate, rather than improving. That is bad for the U. S. peacetime economy. And it can give little comfort to those who are charged with "getting out the goods" in case of a national emergency.

The 10-year age as a general yardstick for obsolescence was adopted by AMERICAN MACHINIST in 1925 at the time the first Inventory was taken. It was essential to have some kind of uniform standard which could be applied to all types of equipment. The fact is recognized that some types of machines over 10 years are still very useful and should not be replaced merely because of their age.

At the same time, it is obvious that much equipment under 10 years old is obsolete in that newer and more efficient units have been developed to do the same work. Moreover, some types of equipment wear out faster than others; and some plants take better care of their machines than others.

On the whole, the 10-year measure seems fair as a determinant of obsolescence. That is the measure which is being used in this Inventory as well as in all past Inventories. For the truth is that relatively few machines in their tenth year are so useful and efficient that they cannot profitably be replaced by newer units.

Aids to Using Inventory

To facilitate use of the Mid-Century Inventory in connection with census and other data, important changes from previous Inventories have been made in the methods of presenting the results. As far as possible, equipment listings conform to the Standard Commodity Code, industry divisions to the Standard Industry Classification, and areas to the marketing areas defined by the Department of Commerce. Separate tables for each of these listings make it easy to locate desired data.

Over and beyond the 10-year yardstick, a second measure has been applied in the Mid-Century Inventory: the number of units over 20 years old. The results are devastating:

376,882 machines tools installed in the nation's metalworking shops are more than 20 years old.

131,455 metal forming units are more than 20 years old.

98,365 units of other shop equipment are more than 20 years old.

That makes a total of 606,702 units of metalworking production equipment in use today which were bought and installed before 1929. There can be no question about their obsolescence and inefficiency.

The charts on pages 130 and 131 are danger signs of unmistakable clarity. The amount of old equipment not only is rising, but also is on the verge of rising at far greater speed than recently.

If present trends are not checked by widespread replacement of old equipment, in 1955 there will be more than 1,400,000 machine tools and perhaps 400,000 units of metal forming equipment at least 10 years old. All of this equipment will be older than its actual age, because of hard wartime usage, round-the-clock operation, and lack of proper maintenance and operation by poorly-trained workers during World War II. And all of it will be very obsolete, because every machine represents prewar design of 1939 or earlier years.

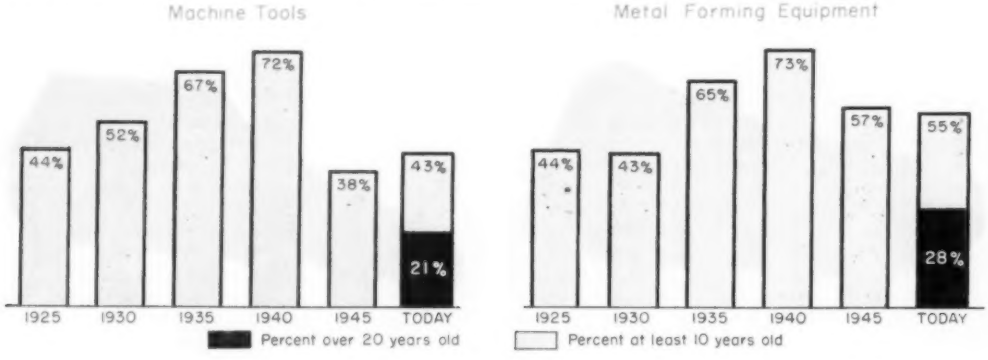
The Mid-Century Inventory is based on thousands of detailed reports showing types and ages of equipment. These reports were prepared by plants of all sizes, in all divisions of metalworking, in all parts of the country. Details of how the Inventory results were translated into published figures are on page 244.

Preliminary data from the 1949 McGraw-Hill Census of Manufacturers also are published with the Inventory. The Census reveals that metalworking industries consist of 19,499 plants with 21 or more workers. These plants employ a total of 5,455,500 wage earners.

From the Census data and the 1947 U.S. Census of Manufacturers, it is estimated that there is a total of 57,800 plants of all sizes in metalworking, with 5,661,000 wage earners.

All statistics on number of plants and wage earners in the Inventory tables are from the preliminary 1949 McGraw-Hill Census.

PERCENTAGE OF OLD MACHINES REPORTED BY SIX INVENTORIES



GRAND SUMMARY

	Units	10 yr & over	Over 20 yr
Machine Tools	1,762,165	43%	21%
Metal Forming	471,257	55	28
Other Equip.	885,280	34	11
Total	3,118,702	42	19

This table summarizes reports from the 15 industry tables and the 25 geographic tables. According to the preliminary 1949 McGraw-Hill Census of Manufacturers there are 19,499 plants with 21 or more workers, employing 5,660,607 people.

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	1,762,165	382,169	376,882
Boring Machines	56,011	12,111	12,063
Horizontal boring, drilling, and milling	17,784	4,410	4,034
Vertical boring mills including vertical turret lathes	19,590	4,105	6,459
Precision, horizontal and vertical	8,910	1,581	360
Jig boring, horizontal and vertical	5,969	1,185	540
Other	3,758	830	670
Broaching Machines	12,891	3,436	1,791
Horizontal internal	4,629	1,262	1,121
Horizontal surface	919	279	58
Vertical internal	2,591	530	320
Vertical surface	3,645	997	159
Other	1,107	366	133
Contour sawing and filing	7,568	1,233	763
Cutoff Machines	80,110	16,745	10,030
Bandsaw	27,377	4,454	2,280
Abrasive disk	10,534	1,751	371
Hacksaws	28,356	6,011	4,281
Rotary, hot or cold	6,941	1,386	1,736
Other	6,904	1,143	1,362
Drilling Machines	261,935	77,256	72,840
Sensitive	76,764	13,973	12,937
Upright: Single-spindle	144,230	30,066	27,907
Gang	56,276	13,295	14,633
Radial	37,353	8,847	6,460
Multi-spindle cluster, adjustable & fixed center	16,865	4,418	3,413
Unit head and way type, multi-spindle	9,311	2,200	1,504
Deep-hole drills	2,772	564	591
Other	18,364	3,893	3,395
Gear Cutting and Finishing Machines	44,216	11,925	10,284
Hobbing machines	15,867	4,545	3,643
Shapers, gear	9,319	2,470	2,285
Cutters, form-milling type	5,784	1,322	2,433
Bevel gear cutters (not planer)	4,621	1,390	949
Cutters, planer type	632	113	289
Grinders, gear	1,729	253	77
Shavers, gear	1,866	403	51
Burnishing and lapping	2,069	725	143
Chamfering, tooth pointing, tooth rounding	1,264	501	157
Other	1,065	202	257
Gear Checking Machines	4,341	845	493
Grinding Machines	362,776	80,862	55,694
External cylindrical, plain and universal	42,586	9,603	7,646
Internal cylindrical	17,477	3,496	2,207
Centerless: External	13,118	3,429	962
Internal	865	314	57
Surface: Rotary table type	14,479	3,188	2,040
Reciprocating type	38,677	8,464	4,420
Disk, horizontal and vertical	15,128	3,654	2,627
Tool and cutter	66,779	13,724	11,648
Bench, floorstand, and snag	108,535	26,605	19,450
Abrasive belt (not polishing)	14,921	2,181	694
Other	30,211	6,204	3,943
Honing and Lapping	17,170	3,280	894
Honing	7,933	1,416	159
Lapping: External	2,857	616	280
Internal	3,078	496	197
Surface	3,302	752	258
Lathes	396,464	86,222	99,334
Bench and floor, light-duty	71,260	15,046	13,861
Engine, heavy-duty, incl toolrm, nfg, aut form, gap	131,198	30,973	43,526
Turret lathes: Ram type and hand screw*	63,827	12,891	13,638
Saddle type	24,633	5,945	4,055
Automatic chucking, horizontal and vertical	17,075	3,835	3,214
Automatic between centers chucking	5,266	1,110	718
Automatic screw machines, bar	66,613	13,702	14,210
Gun and shaft boring	1,286	109	471
Other	15,106	2,611	5,641
Milling Machines	182,284	36,719	45,106
Bench type	7,789	2,037	1,277
Hand	24,999	5,386	8,590
Knee-type, horizontal	60,761	14,064	16,120
Vertical	22,005	5,766	4,415
Automatic and manufacturing	23,185	3,537	4,640
Bed (Lincoln) type, incl automatic rise and fall	9,416	1,288	2,436
Planer type	4,114	1,029	1,437
Die sinkers (except engraving) & duplicators	5,483	1,102	901
Other	14,532	2,510	5,290
Planers	16,570	3,286	9,163
Double housing	10,786	2,033	6,622
Openside	3,845	883	1,518
Other	1,937	370	1,023
Pipe Cutting and Threading Machines	12,419	3,401	2,414
Polishing and Buffing Machines	85,735	17,305	15,662
Speed lathes	23,583	4,660	4,855
Polishing stands	41,746	9,365	8,540
Abrasive belt	12,665	2,129	816
Other	7,741	1,151	1,451
Rifle Boring Machines (not deep-hole drills)	908	67	77
Shapers	42,147	11,663	14,564
Horizontal	31,633	9,017	10,814
Vertical, including slotters	6,451	1,464	2,030
Keyseaters	4,063	1,182	1,720
Threading (except pipe)	54,029	10,325	19,092
Tapping	22,689	4,592	4,983
Hobbing and milling	5,922	1,392	1,264
Die type	5,478	1,694	1,572
Grinders, thread	3,008	250	71
Rolling machines, thread	4,949	1,281	1,833
Other	11,983	1,116	9,369
Other Machine Tools	24,591	5,490	6,618
METAL FORMING MACHINERY	471,257	128,677	131,455
Bending and Forming Machines	52,081	14,856	11,270
Bending rolls, sheet and plate	13,193	3,941	3,877
Bending rolls, bars and shapes	4,450	1,060	1,481
Power bending brakes	13,554	3,531	1,639
Rotary forming machines	4,899	1,359	1,063
Bending machines, pipe and bar	5,454	1,376	846
Other	10,531	3,589	2,364
Hydraulic Presses	32,159	5,520	5,562
Vertical, single action	22,830	3,849	3,496
Vertical, double and triple action	2,496	426	520
Horizontal	3,148	676	1,100
Other (including hydro-pneumatic)	3,685	569	446
Pneumatic Presses (except hydro-pneumatic)	5,089	594	334
Mechanical Presses, Power Driven	230,392	68,273	71,433
Inclinable	111,129	35,338	26,869
Vertical, Column	39,695	12,627	15,799
Vertical, straight-sided	51,276	12,729	20,074
Dieing machines	2,470	733	322
Horizontal	2,775	899	886
Other	23,047	5,947	7,483
Punching and Shearing Machines	59,014	16,582	18,484
Punching machines	21,543	6,295	8,270
Plate and sheet shears	21,995	5,883	5,351
Bar and angle shears	5,406	1,524	2,059
Rotary shears	4,794	1,490	1,519
Other	5,276	1,390	1,285
Forging Machinery (except presses)	24,195	5,232	12,229
Hammers, steam or air	5,930	936	3,013
Hammers, gravity drop	5,986	1,309	3,271
Hammers, helve	2,319	565	1,417
Forging machines (headers) and rolls	7,612	1,763	3,712
Other	2,348	659	816
Swaging Machines	4,739	1,405	1,472
Wire and Strip Forming Machines	13,687	5,167	4,105
Die Casting Machines	8,258	1,068	378
Hot chamber	4,342	656	330
Cold chamber	3,916	412	48
Plastic Molding Machines	8,360	2,282	478
Injection	2,319	273	1
Compression	6,041	2,009	477
Riveting Machines (Not Portable)	33,283	7,698	5,710
OTHER SHOP EQUIPMENT	885,280	203,499	98,365
Electric Welding Machines (Not Hand)	165,101	40,411	8,737
Arc: Motor-generator set	70,640	18,389	2,754
Transformer	24,009	3,141	353
Automatic and other	7,531	1,676	338
Resistance: Spot	44,961	13,030	3,979
Projection	5,226	1,501	223
Gun	3,858	543	55
Seam	2,347	557	137
Butt and flash	6,529	1,574	898
Gas Welding, Cutting Machines (Not Hand)	15,747	3,240	271
Flame cutting	11,072	2,212	181
Welding	4,675	1,028	90
Balancing Machines	5,868	1,480	742
Air Compressors	39,797	8,719	5,186
Plating Equipment	47,176	11,046	2,177
Machines	3,639	667	353
Tanks	33,833	7,581	1,311
Barrels	9,704	2,798	513
Materials Heating Equipment	106,242	26,228	14,937
Heat-treating furnaces	53,678	13,897	7,181
Stock-heating furnaces	17,753	5,008	4,496
Salt baths*	7,067	1,425	452
Induction heating units	5,482	169	174
Baking and drying ovens	20,296	5,401	2,388
Flame hardening	2,066	328	246
Cleaning Equipment	91,541	21,942	11,546
Tumbling barrels	38,586	11,319	8,630
Shot and abrasive blast	12,935	2,227	999
Parts washing machines	15,243	2,965	687
Pickling machines	1,777	360	69
Tanks	23,000	5,071	1,161
Cranes, Overhead Traveling	48,279	8,854	19,360
Hoists (Incl. Jib and Rail Mounting)	270,230	63,807	30,602
Chain, hand	126,258	37,697	15,497
Electric	122,386	19,915	12,271
Pneumatic	21,586	6,195	2,834
Industrial Trucks	95,199	17,772	4,807
Lift	57,995	11,319	3,086
Truck-tractor	12,070	1,610	782
Powered hand trucks	17,114	3,237	154
Crane	8,020	1,606	785

Industrial Analysis

Fifth of Equipment in Six Major Industries Is More Than 20 Years Old

THE AUTOMOBILE industry has the highest percentage of machine tools 10 years old or older (56%) of all segments of the metalworking industries. Its percentage has gone up sharply from 37% in 1945. What is more, automobile makers have a high ratio of machine tools over 20 years old (28%).

Lowest percentage of old machines is to be found in the aircraft industry—not a surprising discovery because of the youth of this industry and its terrific growth during the war. Nevertheless, the aircraft builders have let their metalworking equipment get older, on the average, since 1945. Today 16% of their machine tools are 10 years of age, against only 2% at the war's end.

Aircraft industry's holdings of machine tools have shrunk substantially in recent years. It had installed in its plants at the war peak 276,000 units. Today it has 55,000 units. But in the shrinkage process it has retained all of the 9000 machine tools it owned in 1940.

The railroad equipment industry has been declining in size since 1930. It now is down to 16,000 machine tools. This decrease has been accompanied by an increase in the ratio of old machine tools since 1945. In that year, 42% of its machines were at least 10 years of age. At present the ratio is 48%.

On the other hand, the growth of mechanized farming is reflected in the steady gain in machine tools installed in the agricultural implement industry over the past 20 years. The total stands at 48,000 today, or five times the number in 1930. In this period of acquisition, however, this industry has bought a lot of used machines. The figures show that 50% of the units are at least 10 years old.

Companies making special-industry machinery, office and store machinery, and railroad equipment have more machines over 20 years old than any other industrial classifications.

Of the 15 major industries listed in the Inventory, 12 have shown at least slight improvement in the past five years. These industries have managed to reduce the percentage of machine tools 10 years old or older. All but two of the twelve have expanded during the postwar period (these two are construction-mining-oil well equipment and fabricated metal products).

The remaining three industries had such a large increase in per-

SUMMARY OF INVENTORY DATA BY INDUSTRIES

	ALL EQUIPMENT			MACHINE TOOLS			METAL FORMING EQUIPMENT			OTHER SHOP EQUIPMENT			% of total equip. in each industrial division
	Units	10 yr & Over	Over 20 yr	Units	10 yr & Over	Over 20 yr	Units	10 yr & Over	Over 20 yr	Units	10 yr & Over	Over 20 yr	
Agricultural Machinery	95,975	46%	10%	48,498	50%	25%	10,623	64%	35%	36,854	36%	10%	3.2
Construction, Mining, Oil Well	73,498	43	18	34,983	48	22	5,627	61	35	32,888	35	11	2.3
Metalworking Machinery	201,373	42	20	147,327	43	22	7,193	47	23	46,853	37	15	6.4
Special-Industry Machinery	190,835	52	29	136,412	54	32	13,993	68	37	40,430	39	14	6.1
General Industrial Equipment	157,542	41	18	99,441	44	20	12,702	70	34	45,399	29	10	5.1
Office & Store Machines	65,220	52	32	45,645	52	32	10,700	65	44	8,875	40	16	2.1
Domestic & Service Equipment	96,323	42	16	48,151	42	19	20,357	52	22	27,815	33	7	3.1
Electrical Equipment	302,693	36	16	161,914	37	18	52,866	43	21	87,913	29	10	9.7
Misc. Machine Parts, Jobbing	149,611	40	13	100,847	41	14	13,090	52	19	35,674	32	8	4.8
Motor Vehicles & Parts	249,263	53	26	138,595	56	28	42,382	68	38	68,286	37	12	8.0
Aircraft & Parts	80,036	14	2	54,711	16	2	8,013	13	1	17,312	7	0.2	2.5
Railroad Equipment	34,905	47	29	16,075	48	29	4,629	62	43	14,210	40	25	1.1
Fabricated Metal Products	799,278	46	20	375,717	45	23	196,546	60	28	227,015	35	9	25.7
Shipbuilding, Ordnance, Misc.	455,371	37	18	240,713	36	18	49,701	45	27	164,957	36	14	14.6
Precision Mechanisms	166,779	35	15	113,136	35	15	22,835	46	24	30,808	27	7	5.3
TOTAL	3,118,702	42	19	1,762,165	43	21	471,257	55	28	885,280	34	11	100.0

centage of old machines that the average age for all groups was raised 5%. These industries are automobiles, aircraft and railroad —all of which have shrunk since 1945. The shrinkage is accounted for by elimination of war work which they were doing in 1945 and the redistribution of the surplus machines (largely government-owned) to other industries.

To illustrate: the automotive industry's installation of machine tools grew to 244,000 units in 1945 from 130,000 in 1940. Now the total is back down to 139,000.

Detailed comparison of equipment holdings is not possible in every industry because certain changes have been made in the division of metalworking for the Mid-Century Inventory.

These changes were not made lightly, for the difficulties that would be encountered were recognized. But it was considered desirable to make the division correspond as closely as possible to the Standard Industry Classification.

This classification is being followed for industrial census data and many other studies, so that the use of the Mid-Century Inventory will be facilitated.

These industry groups are defined and the Standard Industry Classification numbers given at the head of each of the tables on pages 142 through 156. Preliminary figures from the 1949 McGraw-Hill Census of Manufacturers for the number of plants and employees in each industry are also given with these tables.

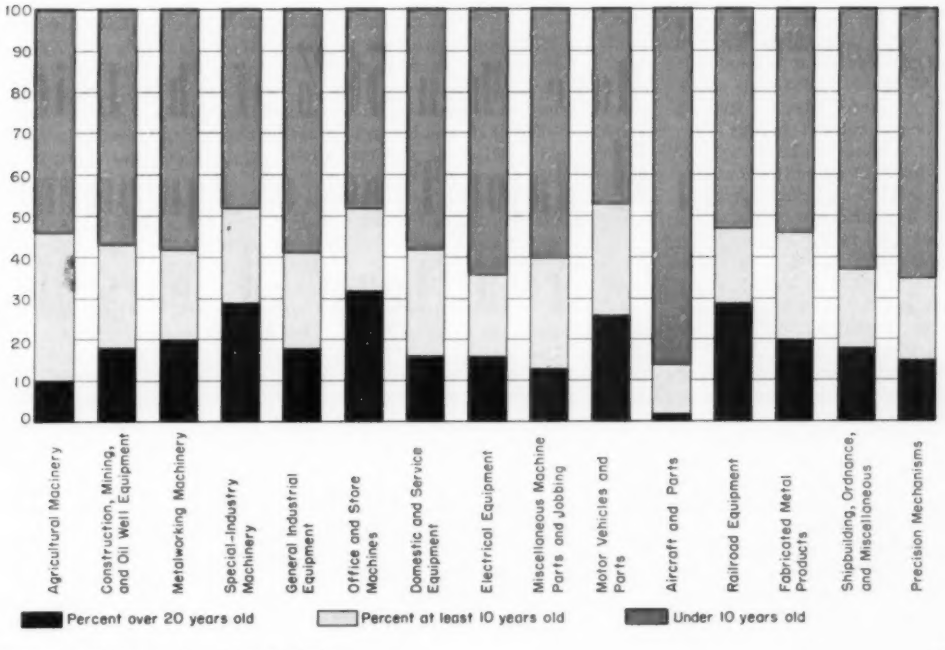
A QUARTER CENTURY OF CHANGE IN METALWORKING INDUSTRIES

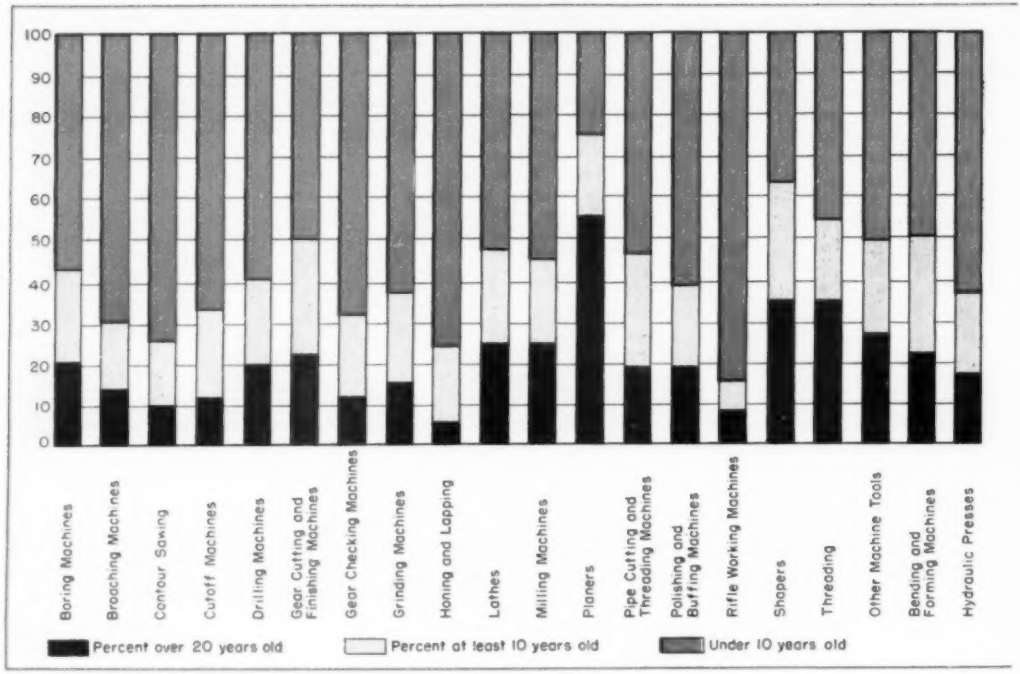
(Percent of Machine Tools At Least 10 Years Old)

	1925	1930	1935	1940	1945	TODAY
Agricultural Machinery	65%	58%	60%	69%	55%	50%
Construction, Mining, Oil Well Equip.	—	49	74	73	49	48
Metalworking Machinery	—	—	66	71	45	43
Special-Industry Machinery	56	45	76	74	57	54
General Industrial Equipment	52	47	75	78	54	44
Office & Store Machines	48	46	74	68	62	52
Domestic & Service Equipment	—	—	62	83	47	42
Electrical Equipment	45	51	65	70	47	37
Misc. Machine Parts, Jobbing	—	—	—	72*	59*	41
Motor Vehicles & Parts	27	27	55	63	37	56
Aircraft & Parts	—	3	13	29	2	16
Railroad Equipment	56	74	71	83	42	48
Fabricated Metal Products	59	49	70	76	47	45
Shipbuilding, Ordnance, Misc.	—	52	—	76**	40	36
Precision Mechanisms	—	—	—	61	36	35
TOTAL	44%	52%	67%	72%	38%	43%

*Includes job shops only.
**Does not include Navy Arsenals.
Note: Percentages from previous Inventories have been adjusted in some cases to provide comparable data. Blanks mean no comparable data is available.

PERCENTAGES OF OLD METALWORKING EQUIPMENT IN 15 INDUSTRIES





Equipment Analysis

More Than 50% of the Units In 11 Major Types of Equipment Are at Least 10 Years Old

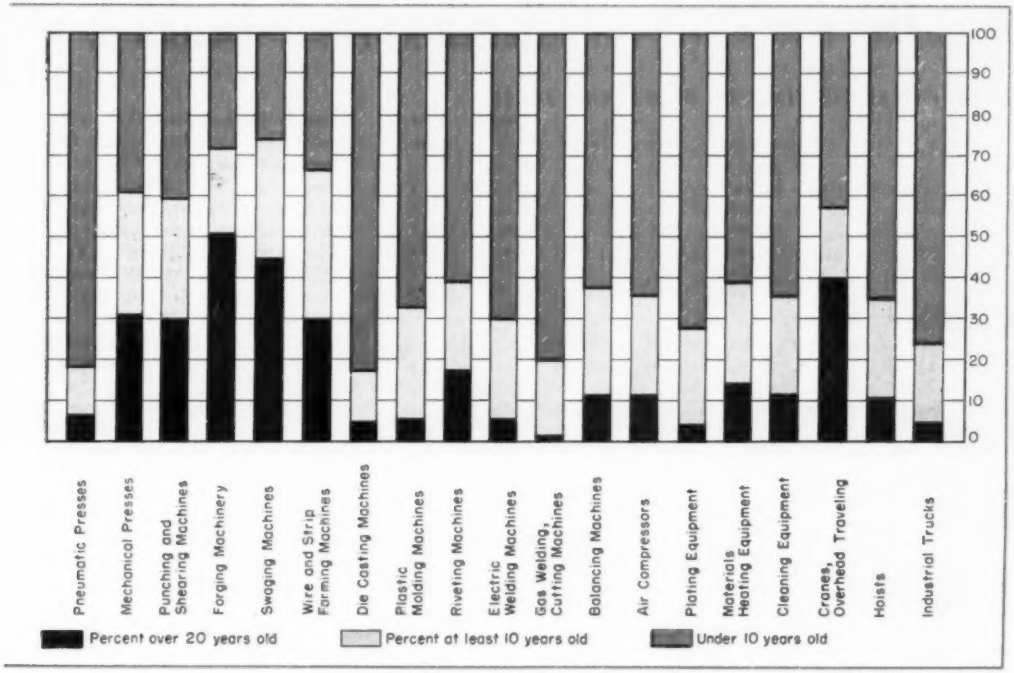
THREE-QUARTERS of the planers in the United States are at least 10 years old. What is worse, 55% of them are more than 20 years old. Yet the tremendous developments in planer design in the last three years make any planer built before 1947 totally obsolete.

More than half of the gear-cutting machines, shapers, threading machines, bending and forming machines, mechanical presses, punching and shearing machines, forging machines, swaging machines, wire and strip forming machines, and cranes are at least 10 years old.

Not only are 72% of the forging machines at least 10 years old, but more than half are more than 20 years old.

Several types of machines have 25% or more units over 20 years old. In addition to planers and forging machines, these include lathes, milling machines, shapers, threading machines, mechanical presses, punching and shearing machines, swaging machines, wire and strip forming machines, and cranes.

Of the 39 major types of equipment reported in the Mid-Century Inventory, the percentage at least 10 years old is higher for 16 types, lower for 11 types, and the same for 4 types. The other eight were



not included in the 1945 Inventory.

There is a sharp increase in the number of broaching machines in use, from 9,701 in 1945 to 12,891 today. Anticipating this increase, the Mid-Century Inventory provides a detailed breakdown of data for five types of broaching machines, rather than grouping them in a single category as in previous Inventories.

Hydraulic presses continue to grow in popularity, with 32,159 today compared with 25,350 in 1945.

The types of equipment reported under "Machine Tools" remain essentially the same as in previous Inventories, although the sub-divisions of some types have been altered somewhat. The greatest changes come in the listing of gear cutting and finishing machines. These had to be changed almost completely in order to make them conform to the Standard Commodity Code.

Gear-checking machines are reported along with gear cutting machines for the first time. There are 4,341 of these, 32% of which are at least 10 years old.

Contour sawing and filing machines, previously included in other cutoff machines, are now listed separately. There are 7,568 of these machines, 26% of which are at least 10 years old.

In considering the relatively small increase in the total number of machine tools (51,028) in Metalworking since 1945, the trend to transfer and other multiple-operation machines must be considered. Frequently, one new machine tool will replace 15 or 20 old ones.

Several types of "Metal Forming Equipment" are now reported in greater detail, notably bending and forming machines, and punching and shearing machines. Pneumatic presses, previously included in other presses, are now in a separate category. There are 5,089, of which 18% are at least 10 years old.

Three additions were made to "Metal Forming Equipment." These include wire and strip forming machines, die casting machines, and plastic molding machines.

The section on "Other Shop Equipment" has been enlarged extensively. Nearly all of the categories provide a more detailed sub-division, particularly materials-heating equipment and cleaning equipment.

Balancing machines are added. There are 5,868, of which 38% are at least 10 years old.

Of special interest, in view of the increased importance of materials handling, is the addition of industrial trucks to the Inventory. There are 95,199 industrial trucks, of which 24% are at least 10 years old, and 5% are more than 20 years old.

Altogether, the Mid-Century Inventory lists 156 different types of equipment in the 39 major groupings. To the greatest possible extent, the division has been made to conform to the Standard Commodity Code.

Distribution of equipment in the various industries and areas covered by the Mid-Century Inventory is shown in the tables on pages 182 through 213. Definitions of each type of equipment and the Standard Commodity Code numbers will be found on these tables.

Geographic Analysis

South's Tools Doubled,

GEOGRAPHICAL DISTRIBUTION OF MACHINE TOOLS

Area*	Machine Tools	10 yr & over	Over 20 yr	Estimated Population** 1,000	Machines Per 1,000 Population
Boston	149,536	47%	27%	4,207	35.5
Bridgeport	107,983	48	33	1,385	77.8
New England	61,986	56	39	3,564	17.4
New York	140,785	39	15	12,684	11.1
Buffalo	48,787	43	19	1,680	29.0
Philadelphia	73,941	43	22	4,747	15.6
Pittsburgh	28,058	54	27	2,500	11.2
Middle Atlantic	130,111	43	26	8,066	16.2
Baltimore	7,423	39	13	1,306	5.7
Southern	135,028	35	7	29,388	4.6
Cleveland	92,300	39	22	2,511	36.8
Cincinnati	32,863	46	27	1,275	25.8
Detroit	122,443	51	26	3,038	40.4
Milwaukee	37,315	43	22	950	39.3
Chicago	120,437	40	15	4,950	24.3
Indianapolis	11,580	34	4	500	23.1
Midwestern	273,829	43	23	16,164	16.9
Minneapolis	11,883	33	13	1,006	11.8
St. Louis	36,257	51	29	2,214	16.5
Central & Mountain	42,007	44	20	15,595	2.7
Houston	6,772	43	12	601	11.2
Southwestern	29,373	39	17	13,593	2.2
San Francisco	12,375	42	19	1,990	6.2
Los Angeles	30,368	24	6	3,917	7.7
Pacific Coast	18,725	26	8	8,549	2.2
TOTAL	1,762,165	43%	21%	146,380	12.0

*See geographic tables for definition of areas. **Population estimates are for 1948, based on data from Bureau of the Census, War Foods Administration, and Consolidated Edison Co. of N. Y.

MACHINE TOOLS installed in shops south of the Mason-Dixon line have more than doubled since V-J Day. To be exact, they have increased from 62,000 in 1945 to 142,000 today, a gain of 2.3 times.

The machine tool concentration in the South (see table, page 133) is about 4.6 per thousand people. That is higher than in any section outside the established metalworking areas (New England, Middle Atlantic and Midwestern states).

This confirmation of the rapid postwar industrialization of the South is one of the notable trends revealed by an analysis of the geographic data in the Mid-Century Inventory. It is accompanied, as is to be expected, by a sharp drop in the percentage of machine tools at least 10 years old—from 48% in 1945 to 35% at present.

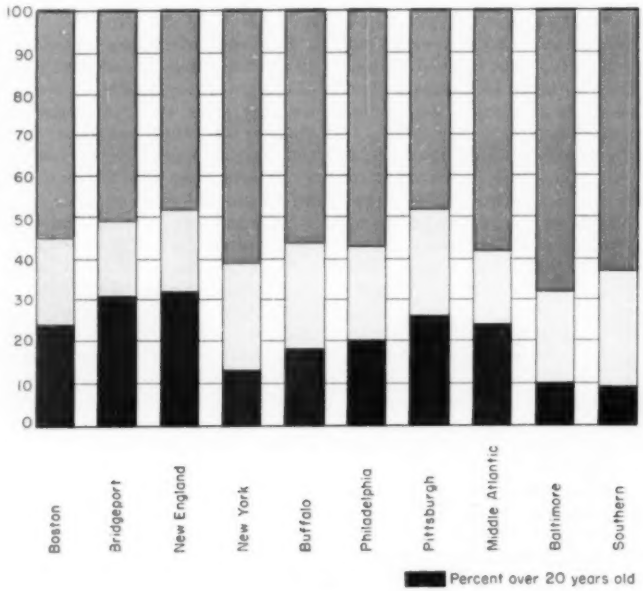
New England, as well as the South, has made important gains in the number of machine tools installed in its metalworking industries. This fact bears out the statement of leading New England industrialists that Metalworking has become the No. 1 industry of New England since the war.

Machine tools installed in New England shops total 320,000 today, compared with only 203,000 in 1945. The percentage of machines 10 years old or older meanwhile has decreased from 57% to 49% in the same period.

By contrast, the dismantling of many war plants reduced the holdings of machine tools in the Midwest from 870,000 in 1945 to 691,000 today. At the same time, the ratio of machines at least 10 years old went up from 33% to 44%. Thus the Midwest has not made a favorable postwar showing.

The Pacific Coast, so dependent on the aircraft industry so far as metalworking goes, has lost much ground. The number of machine

• DISTRIBUTION OF OLD AND NEW



New England's Increased Sharply Since 1945

tools installed in West Coast factories at present is 61,000, down about one-third from the 1945 level.

Highest concentration of machine tools in any marketing area is in the Bridgeport-New Haven-Hartford area in Connecticut. It has 77.8 machine tools per thousand population (against an average concentration of 12 per thousand for the entire country). Detroit and Toledo rank next with 40.4 Lowest concentration in any marketing area is 5.7 in Baltimore.

The dubious honor of being the marketing area with the highest percentage of machine tools 10 years old or older goes to Pittsburgh (54%). The Detroit-Toledo and St. Louis-Kansas City marketing areas follow with 51%. Los Angeles, heart of the West Coast aircraft industry, has the distinction of possessing the lowest percentage of machines which are at least 10 years of age (24 percent).

Bridgeport-New Haven-Hartford area comes into the limelight unfavorably with the greatest concentration of machine tools more than 20 years old (33%). Indianapolis, with only 4%, has the best record in the nation. This is accounted for by a number of large aircraft plants in the area.

In metal forming equipment, the Bridgeport - New Haven - Hartford area makes the poorest showing in average age. Some 67% of the total is at least 10 years old and 44% is more than 20 years old. Los Angeles, thanks again to aircraft, comes out on top, with 26% and 7% respectively. As already pointed out, however, the aircraft industry held onto all of its old machines in making its postwar reductions.

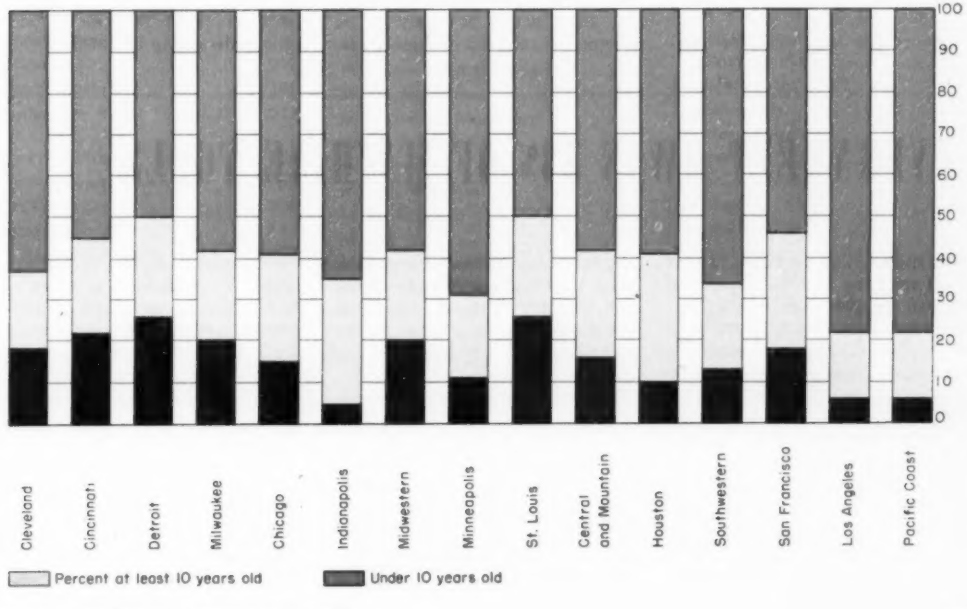
In arriving at these conclusions, AMERICAN MACHINIST editors combined the geographic areas used for the Mid-Century Inventory and those for the 1945 Inventory in various ways to provide comparable data.

The Mid-Century Inventory presents a completely new type of geographic breakdown, one which is much more useful than the method previously followed.

The nine conventional regions have been reduced to seven by combining two regions each in the South, and the Central and Mountain areas. From these seven regions 18 major marketing areas have been segregated and reported separately.

These marketing areas represent the most important metalworking centers and include about 75% of the nation's machine tools. They correspond, either singly or in combinations, to the marketing areas defined by the United States Department of Commerce. Certain combinations of adjacent areas were made to include as many

METALWORKING EQUIPMENT IN 25 GEOGRAPHIC AREAS •



SUMMARY OF INVENTORY DATA BY AREAS

	ALL EQUIPMENT			MACHINE TOOLS			METAL FORMING EQUIPMENT			OTHER SHOP EQUIPMENT			% of total equip. in each geographic area
	Units	10 yr & Over	Over 20 yr	Units	10 yr & Over	Over 20 yr	Units	10 yr & Over	Over 20 yr	Units	10 yr & Over	Over 20 yr	
Boston	234,399	45%	24%	149,536	47%	27%	27,894	60%	35%	56,969	37%	11%	7.5
Bridgeport	168,004	49	31	107,983	48	33	23,445	67	44	36,576	40	17	5.4
New England	98,317	52	32	61,986	56	39	10,819	56	34	25,512	42	17	3.2
New York	244,717	39	13	140,785	39	15	39,544	48	19	64,388	34	6	7.9
Buffalo	81,050	44	18	48,787	43	19	14,744	55	22	17,519	35	9	2.6
Philadelphia	143,043	43	20	73,941	43	22	21,879	55	30	47,223	39	13	4.6
Pittsburgh	63,554	52	26	28,058	54	27	12,993	63	38	22,503	42	16	2.0
Middle Atlantic	228,240	42	24	130,111	43	26	30,065	51	31	68,064	36	19	7.4
Baltimore	13,149	32	10	7,423	39	13	1,629	36	15	4,097	19	4	0.4
Southern	227,578	37	9	135,028	35	7	28,610	51	22	63,940	36	7	7.3
Cleveland	163,415	37	18	92,300	39	22	24,216	51	22	46,899	27	9	5.2
Cincinnati	61,125	45	22	32,863	46	27	10,663	53	26	17,599	39	13	2.0
Detroit	200,216	50	26	122,443	51	26	33,759	70	41	44,014	34	14	6.4
Milwaukee	65,623	42	20	37,315	43	22	7,370	57	32	20,938	34	13	2.1
Chicago	224,963	41	15	120,437	40	15	42,871	54	23	61,655	32	8	7.2
Indianapolis	21,896	35	5	11,580	34	4	2,539	51	20	7,777	32	2	0.7
Midwestern	512,825	42	20	273,829	43	23	78,479	57	28	160,517	33	12	16.5
Minneapolis	23,039	31	11	11,883	33	13	4,333	35	15	6,823	23	3	0.7
St. Louis	72,372	50	26	36,257	51	29	18,753	63	33	17,362	39	14	2.3
Central & Mountain	78,850	42	16	42,007	44	20	9,717	51	19	27,126	33	7	2.5
Houston	12,421	41	10	6,772	43	12	455	48	18	5,204	38	6	0.4
Southwestern	62,674	34	13	29,373	39	17	8,505	47	23	24,796	24	5	2.0
San Francisco	25,695	46	18	12,375	42	19	4,153	59	26	9,167	44	11	0.8
Los Angeles	56,739	22	6	30,368	24	6	8,589	26	7	17,782	19	5	1.8
Pacific	34,798	22	6	18,725	26	8	5,243	25	6	10,830	15	2	1.1
TOTAL	3,118,702	42	19	1,762,165	43	21	471,257	55	28	885,280	34	11	100.0

major areas as possible within a workable number of tables. They are illustrated and defined on pages 157-181, where detailed tabulations are given of the equipment in each area.

The reader who uses the geographic data should remember that they represent approximate distribution based on a relatively large sample (see detailed explanation, page 224). The amount of variation from actual is likely to be greatest in relatively small areas, or for specialized machine types.

One should also remember that the Inventory includes only equipment in metalworking plants. Certain kinds of equipment will be found in large numbers outside the metalworking industry.

GOVERNMENT OWNS 13% OF MACHINE TOOLS

GOVERNMENT agencies own 13% of all machine tools in the nation —some 259,000 items out of the estimated total of 2,061,300. (Inventory total plus estimates of maintenance, college, and reserve tools not in the Inventory.)

All but some 17,000 of the government tools are owned by the Army, Navy and Air Forces, the remainder being held by such organizations as War Assets Administration, National Industrial Equipment Reserve, and the National Industrial Reserve.

Active machine tools owned by the government number about half of the total, or 137,000, and practically all of these are being used by Army, Navy and Air Force or by their contractors.

The 13% figure for government-owned machine tools compares with the 1945 Inventory report of 33%—approximately one-third of all machine tools in the nation. That, of course, was before the release of war-used items to the surplus warehouses and eventual sales back to plants in private industry.

While not complete, these estimates do represent almost all of the machine tools owned by government agencies. For a more accurate figure, to the total of 259,000 should be added the machine tools, at present unknown, owned by the Maritime Commission, Atomic Energy Commission, and others.

Active government machine tools, and those in Ordnance Reserves, are included in the Mid-Century Inventory, and appear in the industry, area, and equipment tables on the following pages.

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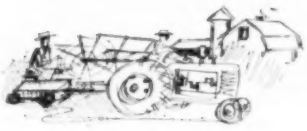
Agricultural Machinery

473 plants, 210,285 employees
(in plants with 21 or more workers)

Tractors; harrowing, plowing, planting, cultivating, irrigating, spraying, harvesting, and threshing machinery; lawn mowers. (Standard Industrial Classification No. 352)



	Units	10 yr & over	Over 20 yr
Machine Tools	48,498	50%	25%
Metal Forming	10,623	64	35
Other Equip.	36,854	36	10
Total	95,975	46	21

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	48,498	12,050	12,221
Boring Machines	2,387	612	640
Horizontal boring, drilling, and milling	820	173	266
Vertical boring mills including vertical turret lathes	820	204	325
Precision, horizontal and vertical	322	142	14
Jig boring, horizontal and vertical	83	21	7
Other	142	62	26
Broaching Machines	650	173	124
Horizontal internal	301	69	90
Horizontal surface	48	7	–
Vertical internal	239	76	31
Vertical surface	59	21	–
Other	3	–	3
Centers: sawing and filing	163	38	7
Cutoff Machines	1,591	364	288
Bandsaw	439	90	28
Abrasive disk	221	42	14
Hacksaws	775	211	208
Rotary, hot or cold	52	7	7
Other	104	14	31
Drilling Machines	13,069	3,411	3,647
Sensitive	1,903	480	415
Upright: Single-spindle	4,678	1,066	1,702
Gang	1,125	311	322
Radial	2,893	772	727
Multi-spindle cluster, adjustable & fixed center	1,100	377	235
Unit head and way type, multi-spindle	429	163	111
Deep-hole drills	104	48	14
Other	837	194	121
Gear Cutting and Finishing Machines	2,962	914	647
Hobbing machines	1,602	519	343
Shapers, gear	429	135	142
Cutters, form-milling type	111	62	21
Bevel gear cutters (not planer)	232	80	55
Cutters, planer type	55	–	31
Grinders, gear	3	–	–
Shavers, gear	167	21	–
Burnishing and lapping	59	21	–
Chamfering, tooth pointing, tooth rounding	142	38	17
Other	166	38	38
Gear Checking Machines	464	142	66
Grinding Machines	9,530	2,260	2,359
External cylindrical, plain and universal	1,145	228	194
Internal cylindrical	394	87	66
Centerless: External	215	45	45
Internal	16	4	–
Surface: Rotary table type	311	69	55
Reciprocating type	381	87	93
Disk, horizontal and vertical	301	104	66
Tool and cutter	2,187	481	322
Bench, floorstand, and snag	4,203	1,093	1,484
Abrasive belt (not polishing)	156	14	3
Other	221	48	31
Honing and Lapping	377	86	41
Honing	263	66	17
Lapping: External	62	17	14
Internal	38	3	10
Surface	14	–	–
Lathes	9,484	2,266	2,326
Bench and floor, light-duty	464	67	87
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	2,370	637	841
Turret lathes: Ram type and hand screw	1,574	266	263
Saddle type	1,169	294	339
Automatic chucking, horizontal and vertical	1,152	311	97
Automatic between centers chucking	1,761	477	426
Automatic screw machines, bar	592	114	128
Gun and shaft boring	111	28	14
Other	291	52	131
Milling Machines	4,032	937	1,003
Bench type	28	10	–
Hand	408	121	114
Knee-type, horizontal	1,059	242	315
Vertical	668	114	173
Automatic and manufacturing	1,038	187	197
Bed (Lincoln) type, incl automatic rise and fall	149	28	24
Planer type	280	66	121
Die sinkers (except engraving) & duplicators	42	3	–
Other	360	166	59
Planers	231	65	125
Double housing	138	35	83
Openside	76	20	35
Other	17	10	7
Pipe Cutting and Threading Machines	263	42	80
Polishing and Buffing Machines	1,138	163	151
Speed lathes	111	28	24
Polishing stands	522	87	100
Abrasive belt	93	31	3
Other	412	17	24
Rifle Working Machines (not deep-hole drills)	3	3	–
Shapers	681	159	322
Horizontal	450	135	190
Vertical, including slotters	138	10	87
Keyseaters	93	14	45
Threading (except pipe)	1,151	339	312
Tapping	453	149	425
Hobbing and milling	232	52	53
Die type	265	100	80
Grinders, thread	7	–	–
Rolling machines, thread	55	10	21
Other	138	26	31
Other Machine Tools	322	76	83
METAL FORMING MACHINERY	10,623	3,025	3,733
Bending and Forming Machines	1,647	592	508
Bending rolls, sheet and plate	564	266	117
Bending rolls, bars and shapes	128	48	42
Power bending brakes	486	128	138
Rotary forming machines	114	35	52
Bending machines, pipe and bar	121	35	38
Other	260	80	121
Hydraulic Presses	931	210	128
Vertical, single action	370	93	24
Vertical, double and triple action	97	10	7
Horizontal	173	48	38
Other (including hydro-pneumatic)	291	59	59
Pneumatic Presses (except hydro-pneumatic)	675	152	73
Mechanical Presses, Power Driven	3,289	934	1,121
Inclinable	827	235	166
Vertical, C-frame	1,088	349	484
Vertical, straight-sided	751	135	236
Dining machines	190	100	–
Horizontal	273	73	125
Other	190	42	90
Punching and Shearing Machines	2,041	543	961
Punching machines	953	135	581
Plate and sheet shears	550	176	201
Bar and angle shears	294	59	131
Rotary shears	173	90	48
Other	121	83	–
Forging Machinery (except presses)	1,224	321	703
Hammers, steam or air	93	14	55
Hammers, gravity drop	450	114	287
Hammers, helve	100	93	87
Forging machines (headers) and rolls	256	83	111
Other	235	17	163
Swaging Machines	17	3	10
Wire and Strip Forming Machines	45	7	35
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	754	263	194
OTHER SHOP EQUIPMENT	36,854	9,390	3,864
Electric Welding Machines (Not Hand)	4,902	867	131
Arc: Motor-generator set	2,377	464	52
Transformer	1,619	152	3
Automatic and other	114	3	–
Resistance: Spot	547	197	55
Projection	76	10	–
Gun	59	14	–
Seam	55	10	7
Butt and flash	55	17	14
Gas Welding, Cutting Machines (Not Hand)	340	79	3
Flame cutting	215	31	3
Welding	125	48	–
Balancing Machines	97	10	3
Air Compressors	737	180	104
Plating Equipment	107	20	–
Machines	17	3	–
Tanks	66	14	–
Barrels	24	3	–
Materials Heating Equipment	3,252	1,201	557
Heat-treating furnaces	1,190	363	173
Stock-heating furnaces	1,460	723	253
Salt baths	107	35	10
Induction heating units	270	17	–
Baking and drying ovens	142	28	21
Flame hardening	83	35	–
Cleaning Equipment	1,698	456	243
Tumbling barrels	460	190	135
Shot and abrasive blast	293	90	21
Parts washing machines	709	159	87
Pickling machines	24	7	–
Tanks	211	10	–
Cranes, Overhead Traveling	1,180	343	253
Hoists (Incl. Jib and Rail Mounting)	19,465	5,452	2,176
Chain, hand	4,332	1,626	1,335
Electric	7,933	1,522	208
Pneumatic	7,200	2,304	633
Industrial Trucks	5,076	782	294
Lift	2,983	557	183
Truck-tractor	830	125	104
Powered hand trucks	986	69	–
Crane	277	31	7

Construction, Mining, Oil Well Equipment

532 plants, 126,991 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**34,983**	**48%**	**22%**
Metal Forming	**5,627**	**61**	**35**
Other Equip.	**32,888**	**35**	**11**
Total	**73,498**	**43**	**18**

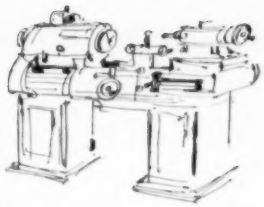
Cement and concrete machinery; cranes and derricks; dredging, excavating, and road-building machinery; mining machinery; oil-refinery machinery; miners' and contractors' portable pneumatic tools; well-drilling machinery. (Standard Industrial Classification No. 353)

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	**34,983**	**9,227**	**7,596**
Boring Machines	2,231	641	591
Horizontal boring, drilling, and milling	868	294	234
Vertical boring mills including vertical turret lathes	1,109	287	327
Precision, horizontal and vertical	127	43	7
Jig boring, horizontal and vertical	80	7	23
Other	47	10	–
Broaching Machines	334	97	64
Horizontal internal	224	60	50
Horizontal surface	27	7	–
Vertical internal	43	20	7
Vertical surface	23	10	–
Other	17	–	7
Contour sawing and filing	70	7	–
Cutoff Machines	1,931	497	227
Bandsaw	456	90	27
Abrasive disk	174	17	3
Hacksaws	979	337	117
Rotary, hot or cold	140	13	53
Other	180	40	27
Drilling Machines	6,516	1,685	1,293
Sensitive	866	167	124
Upright: Single-spindle	2,455	685	598
Gang	367	124	97
Radial	2,138	518	361
Multi-spindle cluster, adjustable & fixed center	227	84	40
Unit head and way type, multi-spindle	120	27	3
Deep-hole drills	60	17	7
Other	271	63	63
Gear Cutting and Finishing Machines	1,542	357	334
Hobbing machines	478	137	87
Shapers, gear	261	67	67
Cutters, form-milling type	574	94	137
Bevel gear cutters (not planer)	70	7	20
Cutters, planer type	53	33	13
Grinders, gear	–	–	–
Shavers, gear	10	3	–
Burnishing and lapping	23	3	–
Chamfering, tooth pointing, tooth rounding	50	13	10
Other	23	–	–
Gear Checking Machines	77	3	3
Grinding Machines	6,826	1,843	1,283
External cylindrical, plain and universal	755	170	124
Internal cylindrical	421	127	110
Centerless: External	137	47	7
Internal	8	3	–
Surface: Rotary table type	220	53	43
Reciprocating type	257	40	50
Disk, horizontal and vertical	154	63	53
Tool and cutter	1,844	401	254
Bench, floor-stand, snag	2,632	852	625
Abrasive belt (not polishing)	174	20	–
Other	224	57	17
Honing and Lapping	193	26	17
Honing	157	23	17
Lapping: External	13	–	–
Internal	20	3	–
Surface	3	–	–
Lathes	9,622	2,584	2,117
Bench and floor, light-duty	631	157	134
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	4,001	1,212	1,289
Turret lathes: Ram type and hand screw	1,917	544	167
Saddle type	1,884	501	424
Automatic chucking, horizontal and vertical	244	73	30
Automatic between centers chucking	134	30	7
Automatic screw machines, bar	180	37	43
Gun and shaft boring	40	17	20
Other	591	13	3
Milling Machines	2,593	621	614
Bench type	40	7	7
Hand	214	27	53
Knee-type, horizontal	1,296	361	327
Vertical	418	67	67
Automatic and manufacturing	277	43	40
Bed (Lincoln) type, incl automatic rise and fall	104	43	3
Planer type	154	53	37
Die sinkers (except engraving) & duplicators	27	10	7
Other	63	10	23
Planers	504	94	321
Double housing	424	77	277
Openside	73	17	37
Other	7	–	7
Pipe Cutting and Threading Machines	424	124	127
Polishing and Buffing Machines	274	46	80
Speed lathes	37	10	13
Polishing stands	174	23	57
Abrasive belt	30	–	–
Other	33	13	10
Rifle Boring Machines (not deep-hole drills)	3	–	–
Shapers	1,119	377	404
Horizontal	671	217	217
Vertical, including slotters	167	53	70
Keyseaters	281	107	117
Threading (except pipe)	654	202	111
Tapping	124	43	20
Hobbing and milling	200	73	10
Die type	214	67	67
Grinders, thread	73	–	–
Rolling machines, thread	10	3	7
Other	33	13	7
Other Machine Tools	70	23	10
METAL FORMING MACHINERY	**5,627**	**1,430**	**1,978**
Bending and Forming Machines	1,017	327	231
Bending rolls, sheet and plate	387	147	114
Bending rolls, bars and shapes	100	43	10
Power bending brakes	300	80	47
Rotary forming machines	37	10	10
Bending machines, pipe and bar	130	20	37
Other	63	27	13
Hydraulic Presses	1,093	233	208
Vertical, single action	608	117	77
Vertical, double and triple action	154	53	17
Horizontal	261	60	97
Other (including hydro-pneumatic)	70	3	17
Pneumatic Presses (except hydro-pneumatic)	23	3	13
Mechanical Presses, Power Driven	1,012	243	284
Inclinable	421	97	53
Vertical, C-frame	200	73	84
Vertical, straight-sided	214	57	77
Dieing machines	3	–	–
Horizontal	77	3	60
Other	97	13	10
Punching and Shearing Machines	1,614	424	799
Punching machines	601	134	381
Plate and sheet shears	521	120	204
Bar and angle shears	251	77	114
Rotary shears	134	43	53
Other	107	50	47
Forging Machinery (except presses)	570	144	350
Hammers, steam or air	284	90	160
Hammers, gravity drop	53	17	33
Hammers, helve	80	7	70
Forging machines (headers) and rolls	73	13	37
Other	80	17	50
Swaging Machines	13	3	7
Wire and Strip Forming Machines	48	–	33
Die Casting Machines	13	–	–
Hot chamber	13	–	–
Cold chamber	–	–	–
Plastic Molding Machines	7	–	–
Injection	–	–	–
Compression	7	–	–
Riveting Machines (Not Portable)	217	53	53
OTHER SHOP EQUIPMENT	**32,888**	**7,861**	**3,562**
Electric Welding Machines (Not Hand)	8,928	2,157	354
Arc: Motor-generator set	5,588	1,676	287
Transformer	2,538	287	–
Automatic and other	478	94	7
Resistance: Spot	234	70	53
Projection	10	–	–
Gun	17	–	–
Seam	20	17	–
Butt and flash	43	13	7
Gas Welding, Cutting Machines (Not Hand)	982	207	20
Flame cutting	818	180	20
Welding	164	27	–
Balancing Machines	80	27	7
Air Compressors	969	204	234
Plating Equipment	177	13	–
Machines	47	10	–
Tanks	120	3	–
Barrels	10	–	–
Materials Heating Equipment	2,949	818	538
Heat-treating furnaces	1,737	518	341
Stock-heating furnaces	474	157	134
Salt baths	284	63	–
Induction heating units	94	7	20
Baking and drying ovens	190	33	40
Flame hardening	170	40	3
Cleaning Equipment	1,078	257	84
Tumbling barrels	220	110	40
Shot and abrasive blast	300	87	30
Parts washing machines	144	23	7
Pickling machines	23	–	–
Tanks	391	37	7
Cranes, Overhead Traveling	2,679	534	658
Hoists (Incl. Jib and Rail Mounting)	12,853	3,270	1,587
Chain, hand	4,843	1,657	1,156
Electric	6,981	1,206	284
Pneumatic	1,029	407	147
Industrial Trucks	2,193	374	80
Lift	1,122	147	53
Truck-tractor	407	77	7
Powered hand trucks	190	–	3
Crane	474	150	17

Metalworking Machinery

1391 plants, 203,938 employees
(in plants with 21 or more workers)

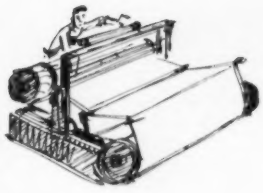
	Units	10 yr & over	Over 20 yr
Machine Tools	**147,327**	**43%**	**22%**
Metal Forming	**7,193**	**47**	**23**
Other Equip.	**46,853**	**37**	**15**
Total	**201,373**	**42**	**20**



Machine tools and other metalworking machinery, including bending machines; presses, forging machines, die-casting machines, can machinery; portable power tools; gas welding apparatus; machine-tool accessories, including cutters, tools, dies, jigs, and fixtures; precision measuring tools. (Standard Industrial Classification No. 354)

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	147,327	31,003	31,941
Boring Machines	6,840	1,528	1,375
Horizontal boring, drilling, and milling	3,100	725	718
Vertical boring mills including vertical turret lathes	1,654	356	409
Precision, horizontal and vertical	698	126	105
Jig boring, horizontal and vertical	1,167	228	90
Other	221	93	53
Broaching Machines	774	195	175
Horizontal internal	521	138	136
Horizontal surface	60	8	13
Vertical internal	103	16	23
Vertical surface	55	18	–
Other	35	13	3
Contour sawing and filing	557	73	13
Cutoff Machines	4,995	1,029	515
Bandsaw	1,679	254	113
Abrasive disk	683	90	40
Hacksaws	2091	562	264
Rotary, hot or cold	321	93	65
Other	221	30	33
Drilling Machines	20,706	4,476	3,483
Sensitive	4,174	718	562
Upright: Single-spindle	7,826	1,812	1,388
Gang	1,913	356	402
Radial	4,761	1,130	803
Multi-spindle cluster, adjustable & fixed center	655	181	123
Unit head and way type, multi-spindle	471	123	105
Deep-hole drills	168	48	45
Other	738	108	55
Gear Cutting and Finishing Machines	4,822	1,092	1,324
Hobbing machines	1,516	397	442
Shapers, gear	984	256	226
Cutters, form-milling type	580	133	146
Bevel gear cutters (not planer)	404	68	136
Cutters, planer type	140	15	60
Grinders, gear	399	85	13
Shavers, gear	181	20	3
Burnishing and lapping	216	48	23
Chamfering, tooth pointing, tooth rounding	176	45	50
Other	223	24	25
Gear Checking Machines	974	208	138
Grinding Machines	37,790	7,709	6,244
External cylindrical, plain and universal	6,259	1,333	1,273
Internal cylindrical	2,487	610	379
Centerless: External	586	113	43
Internal	42	12	6
Surface: Rotary table type	1,905	371	274
Reciprocating type	6,707	1,516	675
Disk, horizontal and vertical	1,074	216	331
Tool and cutter	7,038	1,310	1,375
Bench, floor-stand, and snag	7,570	1,586	1,423
Abrasive belt (not polishing)	1,165	143	68
Other	2,944	499	397
Honing and Lapping	1,455	193	123
Honing	660	98	15
Lapping: External	354	40	45
Internal	243	30	8
Surface	198	25	55
Lathes	31,282	6,771	7,908
Bench and floor, light-duty	5,216	909	991
Engine, heavy-duty, incl toolroom, mfg, aut form, grp	14,013	3,341	4,463
Turret lathes: Ram type and hand screw	4,608	738	828
Saddle type	3,140	761	371
Automatic chucking, horizontal and vertical	530	138	58
Automatic between-centers chucking	208	18	30
Automatic screw machines, bar	2,776	710	718
Gun and shaft boring	58	–	30
Other	733	156	379
Milling Machines	20,789	4,260	5,718
Bench type	438	123	55
Hand	1,345	324	377
Knee-type, horizontal	8,820	2,181	2,302
Vertical	6,136	796	409
Automatic and manufacturing	1,770	173	806
Bed (Lincoln) type, incl automatic rise and fall	904	196	275
Planer type	763	206	198
Die sinkers (except engraving) & duplicators	392	65	50
Other	2,221	196	1,245
Planers	3,318	638	1,504
Double housing	2,535	472	1,283
Openside	590	128	156
Other	193	38	65
Pipe Cutting and Threading Machines	489	103	103
Polishing and Buffing Machines	3,353	578	774
Speed lathes	1,358	201	324
Polishing stands	1,320	264	424
Abrasive belt	155	90	22
Other	120	23	3
Rifle Working Machines (not deep-hole drills)	3	3	–
Shapers	4,163	1,293	1,292
Horizontal	3,077	1,017	896
Vertical, including slotters	622	138	193
Keyseaters	464	138	203
Threading (except pipe)	2,853	593	562
Tapping	547	118	85
Hobbing and milling	1,071	231	306
Die type	218	85	58
Grinders, thread	781	133	50
Rolling machines, thread	95	13	25
Other	141	33	38
Other Machine Tools	2,164	261	690
METAL FORMING MACHINERY	7,193	1,730	1,642
Bending and Forming Machines	971	199	188
Bending rolls, sheet and plate	248	78	75
Bending rolls, bars and shapes	63	10	20
Power bending brakes	281	45	35
Rotary forming machines	50	8	5
Bending machines, pipe and bar	158	28	15
Other	171	30	38
Hydraulic Presses	1,220	201	151
Vertical, single action	861	143	95
Vertical, double and triple action	45	3	3
Horizontal	123	25	45
Other (including hydro-pneumatic)	191	30	8
Pneumatic Presses (except hydro-pneumatic)	103	8	35
Mechanical Presses, Power Driven	2,844	840	626
Inclinable	1,534	522	221
Vertical, C-frame	497	120	161
Vertical, straight-sided	409	133	151
Dieing machines	20	–	8
Horizontal	70	10	15
Other	314	55	70
Punching and Shearing Machines	919	301	263
Punching machines	264	83	90
Plate and sheet shears	397	120	95
Bar and angle shears	113	38	38
Rotary shears	60	20	20
Other	85	40	20
Forging Machinery (except presses)	540	101	306
Hammers, steam or air	291	43	120
Hammers, gravity drop	146	35	50
Hammers, helve	100	13	78
Forging machines (headers) and rolls	45	5	35
Other	48	5	23
Swaging Machines	55	–	10
Wire and Strip Forming Machines	53	5	–
Die Casting Machines	33	5	–
Hot chamber	28	5	–
Cold chamber	5	–	–
Plastic Molding Machines	58	15	–
Injection	28	–	–
Compression	30	15	–
Riveting Machines (Not Portable)	397	55	63
OTHER SHOP EQUIPMENT	46,853	10,453	6,997
Electric Welding Machines (Not Hand)	3,226	603	126
Arc: Motor-generator set	1,669	397	50
Transformer	758	53	5
Automatic and other	168	15	–
Resistance: Spot	397	110	23
Projection	8	–	–
Gun	38	–	–
Seam	15	3	–
Butt and flash	173	25	48
Gas Welding, Cutting Machines (Not Hand)	1,004	153	8
Flame cutting	582	113	3
Welding	422	40	3
Balancing Machines	379	68	50
Air Compressors	1,805	399	208
Plating Equipment	412	106	20
Machines	68	3	–
Tanks	311	95	20
Barrels	33	8	–
Metallurgical Heating Equipment	6,163	1,414	1,109
Heat-treating furnaces	3,893	1,072	665
Stock-heating furnaces	557	78	236
Salt baths	705	128	70
Induction heating units	291	13	–
Baking and drying ovens	469	90	88
Flame hardening	248	33	50
Cleaning Equipment	2,034	291	282
Tumbling barrels	577	100	113
Shot and abrasive blast	633	110	88
Parts washing machines	359	33	28
Pickling machines	43	8	3
Tanks	422	40	50
Cranes, Overhead Traveling	4,907	1,024	1,707
Hoists (Incl. Tab and Rail Mounting)	20,711	5,462	2,724
Chain, hand	11,431	3,574	2,023
Electric	8,788	1,790	648
Pneumatic	492	98	53
Industrial Trucks	6,212	933	763
Lift	2,533	419	153
Truck-tractor	339	35	18
Powered hand trucks	592	45	45
Crane	2,748	434	547

Special-Industry Machinery



1229 plants, 209,304 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**136,412**	**54%**	**32%**
Metal Forming	**13,993**	**68**	**37**
Other Equip.	**40,430**	**39**	**14**
Total	**190,835**	**52**	**29**

Food-products, textile, woodworking, paper-industries, printing-trades, cement-making, glass-making, incandescent lamp-making, paint-making, rubber-working, tobacco-products, shoe-making, and stone-working machinery; smelting and refining equipment. (Standard Industriel Classification No. 355)

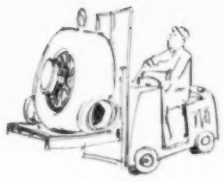
	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	136,412	30,103	43,718
Boring Machines	4,734	944	1,232
Horizontal boring, drilling, and milling	1,529	408	315
Vertical boring mills including vertical turret lathes	1,899	381	806
Precision, horizontal and vertical	348	88	11
Jig boring, horizontal and vertical	359	61	61
Other	99	6	39
Broaching Machines	719	194	266
Horizontal internal	420	88	210
Horizontal surface	66	28	11
Vertical internal	144	50	33
Vertical surface	39	22	6
Other	50	6	6
Contour sawing and filing	486	17	66
Cutoff Machines	5,586	1,204	933
Bandsaw	1,993	304	221
Abrasive disk	668	166	22
Hacksaws	2,180	552	425
Rotary, hot or cold	375	88	138
Other	370	94	127
Drilling Machines	25,717	5,227	7,342
Sensitive	5,150	745	1,546
Upright: Single-spindle	9,202	1,860	2,771
Gang	4,300	723	1,573
Radial	3,422	839	795
Multi-spindle cluster, adjustable & fixed center	1,656	673	425
Unit head and way type, multi-spindle	326	83	44
Deep-hole drills	55	6	-
Other	1,606	298	188
Gear Cutting and Finishing Machines	3,932	1,044	1,955
Hobbing machines	1,231	320	618
Shapers, gear	1,038	293	386
Cutters, form-milling type	1,248	337	784
Bevel gear cutters (not planer)	248	66	116
Cutters, planer type	28	-	17
Grinders, gear	11	6	6
Shavers, gear	6	-	-
Burnishing and lapping	28	11	-
Chamfering, tooth pointing, tooth rounding	17	-	6
Other	77	11	22
Gear Checking Machines	144	33	50
Grinding Machines	24,807	5,768	5,729
External cylindrical, plain and universal	2,876	552	872
Internal cylindrical	756	166	171
Centerless: External	337	66	22
Internal	5	-	5
Surface: Rotary table type	905	221	144
Reciprocating type	1,904	403	293
Disk, horizontal and vertical	1,270	397	237
Tool and cutter	3,787	883	662
Bench, floorstand, and snag	10,505	2,594	2,931
Abrasive belt (not polishing)	1,231	221	138
Other	1,231	265	254
Honing and Lapping	498	45	34
Honing	392	28	17
Lapping: External	17	-	-
Internal	39	17	-
Surface	50	-	17
Lathes	30,835	6,723	11,929
Bench and floor, light-duty	4,786	856	1,601
Engine, heavy-duty, incl toolrm, mfg, ast form, gap	14,026	3,069	6,894
Turret lathes: Ram type and hand screw	6,216	1,540	1,750
Saddle type	2,230	386	486
Automatic chucking, horizontal and vertical	822	210	237
Automatic between centers chucking	88	39	-
Automatic screw machines, bar	2,120	524	613
Gun and shaft boring	11	-	11
Others	536	99	237
Milling Machines	16,372	3,378	5,659
Bench type	270	88	144
Hand	1,601	459	679
Knee-type, horizontal	7,413	1,628	2,683
Vertical	2,561	491	602
Automatic and manufacturing	2,429	453	817
Bed (Lincoln) type, incl automatic rise and fall	408	11	83
Planer type	502	83	265
Die sinkers (except engraving) & duplicators	232	6	11
Other	956	149	375
Planers	2,451	492	1,534
Double housing	1,590	348	1,104
Openside	524	105	215
Other	337	39	215
Pipe Cutting and Threading Machines	800	232	160
Polishing and Buffing Machines	5,449	1,098	1,679
Speed lathes	2,103	364	751
Polishing stands	1,888	469	668
Abrasive belt	1,038	182	166
Other	420	83	94
Rifle Boring Machines (not deep-hole drills)	-	-	-
Shapers	3,522	1,015	1,501
Horizontal	2,407	662	1,065
Vertical, including slotters	392	127	132
Keyseaters	723	226	304
Threading (except pipe)	1,420	315	414
Tapping	602	105	149
Hobbing and milling	381	116	132
Die type	243	66	99
Grinders, thread	39	-	6
Rolling machines, thread	17	-	6
Other	138	22	22
Other Machine Tools	9,440	2,374	3,235
METAL FORMING MACHINERY	13,993	4,311	3,234
Bending and Forming Machines	2,495	750	822
Bending rolls, sheet and plate	707	237	282
Bending rolls, bars and shapes	237	28	149
Power bending brakes	502	171	66
Rotary forming machines	193	121	22
Bending machines, pipe and bar	298	66	55
Other	558	127	248
Hydraulic Presses	1,650	436	475
Vertical, single action	850	155	144
Vertical, double and triple action	298	132	99
Horizontal	342	99	160
Other (including hydro-pneumatic)	160	50	72
Pneumatic Presses (except hydro-pneumatic)	39	11	-
Mechanical Presses, Power Driven	4,200	1,318	1,586
Inclinable	2,528	861	729
Vertical, C-frame	624	193	326
Vertical, straight-sided	552	132	309
Dieing machines	77	55	6
Horizontal	55	33	6
Other	364	44	210
Punching and Shearing Machines	2,887	983	977
Punching machines	1,165	442	386
Plate and sheet shears	949	287	293
Bar and angle shears	304	132	66
Rotary shears	204	83	72
Other	265	39	160
Forging Machinery (except presses)	844	160	635
Hammers, steam or air	237	44	177
Hammers, gravity drop	171	11	138
Hammers, helve	182	17	154
Forging machines (headers) and rolls	127	22	105
Other	127	66	61
Swaging Machines	199	61	138
Wire and Strip Forming Machines	331	28	270
Die Casting Machines	17	17	-
Hot chamber	-	-	-
Cold chamber	17	17	-
Plastic Molding Machines	453	326	-
Injection	33	17	-
Compression	420	309	-
Riveting Machines (Not Portable)	878	221	331
OTHER SHOP EQUIPMENT	40,430	10,054	5,852
Electric Welding Machines (Not Hand)	6,130	1,243	332
Arc: Motor-generator set	4,146	751	144
Transformer	673	132	17
Automatic and other	171	28	11
Resistance: Spot	867	276	121
Projection	50	-	-
Gun	66	6	-
Seam	28	-	6
Butt and flash	149	50	33
Gas Welding, Cutting Machines (Not Hand)	1,181	226	39
Flame cutting	811	171	33
Welding	370	55	6
Balancing Machines	403	99	61
Air Compressors	2,445	640	530
Plating Equipment	1,132	409	11
Machines	83	11	-
Tanks	867	337	11
Barrels	182	61	-
Materials Heating Equipment	3,599	983	530
Heat-treating furnaces	2,191	635	354
Stock-heating furnaces	320	138	77
Salt baths	502	99	55
Induction heating units	144	17	-
Baking and drying ovens	293	66	33
Flame hardening	149	28	11
Cleaning Equipment	4,036	1,391	728
Tumbling barrels	2,418	900	502
Shot and abrasive blast	541	144	121
Parts washing machines	304	66	72
Pickling machines	44	11	-
Tanks	729	270	72
Cranes, Overhead Traveling	2,655	607	889
Hoists (Incl. Jib and Rail Mounting)	14,755	3,594	2,445
Chain, hand	7,248	2,578	1,507
Electric	6,867	867	618
Pneumatic	640	149	320
Industrial Trucks	4,074	862	287
Lift	2,832	701	237
Truck-tractor	403	39	28
Powered hand trucks	646	61	-
Crane	193	61	22

General Industrial Equipment

1099 plants, 212,205 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**99,441**	**44%**	**20%**
Metal Forming	**12,702**	**70**	**34**
Other Equip.	**45,399**	**29**	**10**
Total	**157,542**	**41**	**18**

Pumps, compressors (except refrigeration); elevators; conveyors; industrial blowers; industrial trucks, tractors, trailers, and stackers; power transmission equipment (except ball and roller bearings), including gears, clutches, speed reducers, chains, sprockets; furnaces. (Standard Industrial Classification No. 356)



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	99,441	23,493	19,874
Boring Machines	4,242	1,115	976
Horizontal boring, drilling, and milling	1,187	389	392
Vertical boring mills including vertical turret lathes	1,930	532	551
Precision, horizontal and vertical	730	95	66
Jig boring, horizontal and vertical	239	44	7
Other	176	55	40
Broaching Machines	1,046	286	191
Horizontal internal	629	209	125
Horizontal surface	84	4	–
Vertical internal	242	55	37
Vertical surface	48	7	18
Other	23	11	11
Contour sawing and filing	264	15	11
Cutoff Machines	4,403	1,153	591
Bandsaw	1,303	250	114
Abrasive disk	602	143	7
Hacksaws	1,930	639	235
Rotary, hot or cold	451	110	191
Other	117	11	44
Drilling Machines	19,627	4,496	3,716
Sensitive	3,332	804	672
Upright: Single spindle	8,012	1,787	1,516
Gang	2,397	499	371
Radial	2,764	679	628
Multi-spindle cluster, adjustable & fixed center	1,464	400	242
Unit head and way type, multi-spindle	297	70	15
Deep-hole drills	139	70	4
Other	1,222	187	268
Gear Cutting and Finishing Machines	7,025	2,023	1,605
Hobbing machines	2,496	782	503
Shapers, gear	1,417	360	235
Cutters, form-milling type	705	198	393
Bevel gear cutters (not planer)	1,167	327	294
Cutters, planer type	165	40	95
Grinders, gear	425	26	18
Shavers, gear	264	40	4
Burnishing and lapping	378	147	26
Chamfering, tooth pointing, tooth rounding	202	55	22
Other	106	48	15
Gear Checking Machines	763	139	110
Grinding Machines	18,148	4,281	2,513
External cylindrical, plain and universal	2,521	536	4,157
Internal cylindrical	1,219	283	154
Centerless: External	327	51	15
Internal	24	4	6
Surface: Rotary table type	1,006	264	121
Reciprocating type	1,050	195	139
Disk, horizontal and vertical	532	191	110
Tool and cutter	3,509	898	415
Bench, floor and pedestal	6,279	1,582	1,046
Abrasive belt (not polishing)	646	70	15
Other	936	217	77
Honing and Lapping	873	147	15
Honing	562	88	11
Lapping: External	62	26	–
Internal	106	15	4
Surface	143	18	–
Lathes	26,621	6,132	6,202
Bench and floor, light-duty	3,428	756	411
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	7,931	1,967	2,896
Turret lathes: Ram type and hand screw	6,173	1,233	1,285
Saddle type	3,232	811	484
Automatic chucking, horizontal and vertical	1,974	466	297
Automatic between centers chucking	547	143	73
Automatic screw machines, bar	2,697	620	584
Gun and shell boring	7	–	–
Other	532	135	172
Milling Machines	8,142	1,805	1,669
Bench type	391	95	40
Hand	1,387	378	297
Knee-type, horizontal	3,321	749	749
Vertical	1,218	187	106
Automatic and manufacturing	278	161	121
Bed (Lincoln) type, incl automatic rise and fall	220	26	51
Planer type	378	121	99
Die sinkers (except engraving) & duplicators	44	–	15
Other	495	88	191
Planers	646	140	415
Double housing	426	92	297
Openside	169	26	92
Other	51	22	26
Pipe Cutting and Threading Machines	653	176	132
Polishing and Buffing Machines	2,117	414	278
Speed lathes	708	165	66
Polishing stands	796	150	165
Abrasive belt	499	73	33
Other	114	26	15
Rifle Working Machines (not deep-hole drills)	7	–	–
Shapers	2,140	536	870
Horizontal	1,259	297	521
Vertical, including slotters	272	48	92
Keyseaters	609	191	257

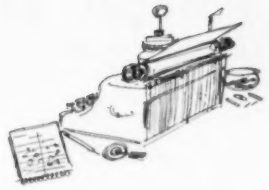
	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	1,917	536	304
Tapping	749	180	51
Hobbing and milling	672	235	165
Die type	239	66	51
Grinders, thread	136	29	–
Rolling machines, thread	29	–	–
Other	92	26	37
Other Machine Tools	807	99	275
METAL FORMING MACHINERY	12,702	2,891	4,358
Bending and Forming Machines	2,495	573	757
Bending rolls, sheet and plate	657	180	246
Bending rolls, bars and shapes	231	55	92
Power bending brakes	639	125	125
Rotary forming machines	139	48	37
Bending machines, pipe and bar	418	84	62
Other	411	81	195
Hydraulic Presses	1,355	334	305
Vertical, single action	940	220	176
Vertical, double and triple action	121	15	48
Horizontal	202	88	55
Other (including hydro-pneumatic)	92	11	26
Pneumatic Presses (except hydro-pneumatic)	279	33	51
Mechanical Presses, Power Driven	4,566	991	1,586
Inclinable	2,195	528	628
Vertical, C-frame	962	228	268
Vertical, straight-sided	848	77	477
Boring machines	26	11	4
Horizontal	62	11	33
Other	473	136	176
Punching and Shearing Machines	2,562	612	776
Punching machines	1,050	242	510
Plate and sheet shears	837	176	246
Bar and angle shears	308	88	128
Rotary shears	213	55	66
Other	154	51	26
Forging Machinery (except presses)	293	47	162
Hammers, steam or air	161	18	114
Hammers, gravity drop	26	4	22
Hammers, helve	37	7	11
Forging machines (headers) and rolls	18	–	–
Other	51	18	15
Swaging Machines	62	18	4
Wire and Strip Forming Machines	231	29	172
Die Casting Machines	26	7	4
Hot chamber	22	7	4
Cold chamber	4	–	–
Plastic Molding Machines	77	22	–
Injection	18	–	–
Compression	59	22	–
Riveting Machines (Not Portable)	756	143	341
OTHER SHOP EQUIPMENT	45,399	10,491	4,440
Electric Welding Machines (Not Hand)	7,822	1,681	588
Arc: Motor-generator set	4,731	1,193	195
Transformer	1,505	198	11
Automatic and other	193	15	4
Resistance: Spot	778	198	73
Projection	106	7	26
Gun	59	18	–
Seam	15	4	–
Butt and flash	437	48	279
Gas Welding, Cutting Machines (Not Hand)	1,042	195	15
Flame cutting	745	136	11
Welding	297	59	4
Balancing Machines	466	88	37
Air Compressors	1,919	382	235
Plating Equipment	520	113	29
Machines	73	7	7
Tanks	374	84	15
Barrels	73	22	7
Materials Heating Equipment	3,687	908	450
Heat-treating furnaces	2,341	606	327
Stock-heating furnaces	279	81	29
Salt baths	352	81	18
Induction heating units	176	4	7
Baking and drying ovens	451	125	62
Flame hardening	88	11	7
Cleaning Equipment	3,050	525	826
Tumbling barrels	1,211	125	701
Shot and abrasive blast	562	121	59
Parts washing machines	492	79	7
Pickling machines	40	–	–
Tanks	745	209	59
Cranes, Overhead Traveling	3,031	822	811
Hoists (Incl. Jib and Rail Mounting)	18,863	5,116	1,336
Chain, hand	8,580	3,064	947
Electric	7,751	1,501	209
Pneumatic	2,532	551	180
Industrial Trucks	4,999	661	113
Lift	3,325	525	48
Truck-tractor	525	37	29
Powered hand trucks	899	73	7
Crane	250	26	29

Office and Store Machines

198 plants, 116,545 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**45,645**	**52%**	**32%**
Metal Forming	**10,700**	**65**	**44**
Other Equip.	**8,875**	**40**	**16**
Total	**65,220**	**52**	**32**

Computing machines; cash registers, typewriters; vending, amusement, and other coin-operated machines; scales and balances; duplicating and mailing machines; canceling and other protective machines. (Standard Industrial Classification No. 357)



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	45,645	8,930	14,874
Boring Machines	330	106	61
Horizontal boring, drilling, and milling	41	4	12
Vertical boring mills including vertical turret lathes	4	4	–
Precision, horizontal and vertical	73	33	–
Jig boring, horizontal and vertical	208	65	49
Other	4	–	–
Broaching Machines	158	28	20
Horizontal internal	53	24	16
Horizontal surface	–	–	–
Vertical internal	24	–	–
Vertical surface	77	4	–
Other	4	–	4
Contour sawing and filing	395	53	171
Cutoff Machines	635	163	126
Bandsaw	293	57	69
Abrasive disk	37	8	–
Hacksaws	256	94	45
Rotary, hot or cold	41	–	12
Other	8	4	–
Drilling Machines	12,978	2,353	3,687
Sensitive	6,072	1,123	1,872
Upright: Single-spindle	2,556	387	619
Gang	2,629	562	598
Radial	106	20	28
Multi-spindle cluster, adjustable & fixed center	716	167	285
Unit head and way type, multi-spindle	480	33	216
Deep-hole drills	8	4	–
Other	411	57	69
Gear Cutting and Finishing Machines	1,001	260	427
Hobbing machines	611	183	240
Shapers, gear	138	41	20
Cutters, form-milling type	187	16	151
Bevel gear cutters (not planer)	45	16	8
Cutters, planer type	–	–	–
Grinders, gear	–	–	–
Shavers, gear	4	–	–
Burnishing and lapping	16	4	8
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	4	–	–
Grinding Machines	7,243	2,052	1,354
External cylindrical, plain and universal	863	179	175
Internal cylindrical	260	69	33
Centerless: External	191	69	24
Internal	3	1	–
Surface: Rotary table type	199	61	52
Reciprocating type	1,502	761	159
Disk, horizontal and vertical	212	69	49
Tool and cutter	757	163	232
Bench, floorstand, and snag	2,564	615	480
Abrasive belt (not polishing)	513	45	85
Other	179	20	65
Honing and Lapping	57	4	–
Honing	45	–	–
Lapping: External	12	4	–
Internal	–	–	–
Surface	–	–	–
Lathes	10,733	1,294	4,627
Bench and floor, light-duty	1,929	265	700
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	1,563	277	859
Turret lathes: Ram type and hand screw	912	61	256
Saddle type	49	16	12
Automatic chucking, horizontal and vertical	94	12	24
Automatic between centers chucking	20	4	4
Automatic screw machines, bar	6,154	651	2,772
Gun and shaft boring	–	–	–
Other	12	8	–
Milling Machines	8,070	1,400	2,702
Bench type	322	114	85
Hand	1,608	183	582
Knee-type, horizontal	2,002	366	1,095
Vertical	537	102	151
Automatic and manufacturing	2,568	476	370
Bed (Lincoln) type, incl automatic rise and fall	195	4	61
Planer type	16	–	8
Die sinkers (except engraving) & duplicators	41	8	16
Other	781	147	334
Planers	81	28	52
Double housing	41	12	28
Openside	28	12	16
Other	12	4	8
Pipe Cutting and Threading Machines	69	24	12
Polishing and Buffing Machines	1,738	636	639
Speed lathes	167	37	57
Polishing stands	1,396	562	558
Abrasive belt	134	4	20
Other	41	33	4
Rifle Rerhing Machines (not deep-hole drills)	–	–	–
Shapers	395	106	130
Horizontal	362	94	118
Vertical, including slotters	33	12	12
Keyseaters	–	–	–
Threading (except pipe)	1,424	342	675
Tapping	1,351	342	651
Hobbing and milling	8	–	4
Die type	16	–	8
Grinders, thread	12	–	–
Rolling machines, thread	37	–	12
Other	–	–	–
Other Machine Tools	334	81	191
METAL FORMING MACHINERY	10,700	2,217	4,719
Bending and Forming Machines	447	138	138
Bending rolls, sheet and plate	73	4	37
Bending rolls, bars and shapes	12	–	12
Power bending brakes	69	8	4
Rotary forming machines	–	–	–
Bending machines, pipe and bar	45	16	8
Other	248	110	77
Hydraulic Presses	386	24	–
Vertical, single action	334	20	–
Vertical, double and triple action	16	4	–
Horizontal	8	–	–
Other (including hydro-pneumatic)	28	–	–
Pneumatic Presses (except hydro-pneumatic)	57	4	4
Mechanical Presses, Power Driven	6,279	1,221	3,166
Inclinable	2,674	480	1,144
Vertical, C-frame	2,751	582	1,579
Vertical, straight-sided	541	81	346
Dieing machines	114	33	12
Horizontal	–	–	–
Other	199	45	85
Punching and Shearing Machines	406	122	154
Punching machines	28	4	24
Plate and sheet shears	305	110	81
Bar and angle shears	4	–	4
Rotary shears	41	4	33
Other	28	4	12
Forging Machinery (except presses)	60	–	52
Hammers, steam or air	8	–	4
Hammers, gravity drop	28	–	24
Hammers, helve	4	–	4
Forging machines (headers) and rolls	20	–	20
Other	–	–	–
Swaging Machines	126	24	81
Wire and Strip Forming Machines	118	57	33
Die Casting Machines	216	–	163
Hot chamber	212	–	163
Cold chamber	4	–	–
Plastic Molding Machines	216	118	4
Injection	53	–	–
Compression	163	118	4
Riveting Machines (Not Portable)	2,389	509	924
OTHER SHOP EQUIPMENT	8,875	2,106	1,419
Electric Welding Machines (Not Hand)	1,342	391	167
Arc: Motor-generator set	260	114	4
Transformer	20	–	–
Automatic and other	4	–	–
Resistance: Spot	708	167	159
Projection	236	102	4
Gun	53	–	–
Seam	28	–	–
Butt and flash	33	8	–
Gas Welding, Cutting Machines (Not Hand)	52	8	–
Flame cutting	24	4	–
Welding	28	4	–
Balancing Machines	41	12	4
Air Compressors	220	69	16
Plating Equipment	1,848	561	40
Machines	106	12	12
Tanks	1,420	480	–
Barrels	322	69	28
Materials Heating Equipment	1,506	309	240
Heat-treating furnaces	635	163	102
Stock-heating furnaces	77	24	4
Salt baths	216	33	24
Induction heating units	73	4	–
Baking and drying ovens	456	73	94
Flame hardening	49	12	16
Cleaning Equipment	2,156	451	663
Tumbling barrels	1,363	250	390
Shot and abrasive blast	85	12	16
Parts washing machines	289	81	49
Pickling machines	8	–	–
Tanks	411	8	8
Cranes, Overhead Traveling	57	–	4
Hoists (Incl. Jib and Rail Mounting)	887	195	69
Chain, hand	460	167	69
Electric	423	28	–
Pneumatic	4	–	–
Industrial Trucks	766	110	216
Lift	602	98	212
Truck-tractor	37	8	4
Powered hand trucks	94	–	–
Crane	33	4	–

Domestic and Service Equipment

648 plants, 259,306 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	48,151	42%	19%
Metal Forming	20,357	52	22
Other Equip.	27,815	33	7
Total	96,323	42	16

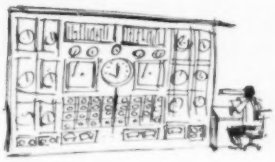
Domestic and commercial washers, wringers, driers, and ironers; sewing machines; vacuum cleaners; air-conditioning and refrigeration equipment; electrical appliances, including ranges, toasters, percolators, and fans. (Standard Industrial Classification No. 358,-362)

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	45,151	11,358	9,157
Boring Machines	1,863	435	164
Horizontal boring, drilling, and milling	382	93	43
Vertical boring mills including vertical turret lathes	200	64	39
Precision, horizontal and vertical	990	246	25
Jig boring, horizontal and vertical	187	22	32
Other	104	10	25
Broaching Machines	398	95	48
Horizontal internal	150	55	23
Horizontal surface	20	8	–
Vertical internal	66	5	10
Vertical surface	159	27	15
Other	3	–	–
Contour sawing and filing	174	37	8
Cutoff Machines	2,146	490	342
Bandsaw	732	131	101
Abrasive disk	272	55	15
Hacksaws	609	208	75
Rotary, hot or cold	434	84	124
Other	99	12	27
Drilling Machines	11,923	2,923	2,544
Sensitive	2,447	598	499
Upright: Single-spindle	4,146	1,147	696
Gang	3,324	650	907
Radial	718	156	181
Multi-spindle cluster, adjustable & fixed center	387	90	102
Unit head and way type, multi-spindle	260	53	32
Deep-hole drills	48	8	23
Other	593	225	104
Gear Cutting and Finishing Machines	722	219	102
Hobbing machines	366	82	58
Shapers, gear	206	84	28
Cutters, form-milling type	10	10	–
Bevel gear cutters (not planer)	56	3	10
Cutters, planer type	10	5	–
Grinders, gear	3	3	–
Shavers, gear	23	8	3
Burnishing and lapping	20	8	3
Chamfering, tooth pointing, tooth rounding	15	13	–
Other	13	3	–
Gear Checking Machines	41	16	–
Grinding Machines	9,939	2,288	1,716
External cylindrical, plain and universal	1,225	254	211
Internal cylindrical	372	103	37
Centerless: External	700	151	30
Internal	8	2	–
Surface: Rotary table type	482	154	75
Reciprocating type	1,264	316	135
Disk, horizontal and vertical	494	147	104
Tool and cutter	2,774	587	543
Bench, floor-stand, and snag	1,884	487	365
Abrasive belt (not polishing)	236	32	10
Other	483	55	206
Honing and Lapping	649	186	26
Honing	282	66	5
Lapping: External	50	11	3
Internal	119	23	15
Surface	198	84	3
Lathes	10,047	2,313	1,901
Bench and floor, light-duty	1,689	467	274
Engine, heavy-duty, incl toolrm, stg, aut feed, gap	2,875	716	747
Turret lathes: Ram type and hand screw	1,861	267	430
Saddle type	487	151	48
Automatic chucking, horizontal and vertical	706	219	125
Automatic between centers chucking	59	13	5
Automatic screw machines, bar	2,077	394	209
Gun and shaft boring	–	–	–
Other	293	86	67
Milling Machines	3,757	763	698
Bench type	179	42	27
Hand	728	172	164
Knee-type, horizontal	1,175	222	215
Vertical	642	129	82
Automatic and manufacturing	505	116	78
Bed (Lincoln) type, incl automatic rise and fall	261	50	56
Planer type	32	12	17
Die sinkers (except engraving) & duplicators	40	12	2
Other	175	29	55
Planers	199	57	55
Double housing	83	26	40
Openside	63	29	7
Other	53	8	8
Pipe Cutting and Threading Machines	276	83	40
Polishing and Buffing Machines	3,202	718	891
Speed lathes	593	164	171
Polishing stands	1,730	404	553
Abrasive belt	294	32	38
Other	585	118	129
Rifle Boring Machines (not deep-hole drills)	9	–	–
Shapers	835	277	230
Horizontal	645	221	171
Vertical, including slotters	117	27	30
Keyseaters	73	29	27
Threading (except pipe)	1,572	370	363
Tapping	1,171	301	283
Hobbing and milling	115	22	12
Die type	81	20	32
Grinders, thread	27	–	–
Rolling machines, thread	95	23	21
Other	33	4	15
Other Machine Tools	405	86	31
METAL FORMING MACHINERY	20,357	6,031	4,424
Bending and Forming Machines	2,295	776	280
Bending rolls, sheet and plate	586	181	97
Bending rolls, bars and shapes	91	32	12
Power bending brakes	768	305	96
Rotary forming machines	224	58	40
Bending machines, pipe and bar	143	149	20
Other	483	51	15
Hydraulic Presses	965	213	54
Vertical, single action	785	184	42
Vertical, double and triple action	79	8	5
Horizontal	34	10	2
Other (including hydro-pneumatic)	67	11	5
Pneumatic Presses (except hydro-pneumatic)	248	23	8
Mechanical Presses, Power Driven	11,988	3,567	3,319
Inclinable	6,273	1,588	1,882
Vertical, C-frame	1,850	761	358
Vertical, straight-sided	2,236	843	392
Dieing machines	62	23	15
Horizontal	64	15	39
Other	1,503	327	633
Punching and Shearing Machines	1,858	546	400
Punching machines	512	157	96
Plate and sheet shears	1,115	314	269
Bar and angle shears	74	20	14
Rotary shears	106	31	18
Other	51	24	3
Forging Machinery (except presses)	210	17	109
Hammers, steam or air	56	7	5
Hammers, gravity drop	56	–	44
Hammers, helve	40	3	30
Forging machines (headers) and rolls	35	3	25
Other	23	4	5
Swaging Machines	250	82	15
Wire and Strip Forming Machines	360	180	23
Die Casting Machines	164	55	12
Hot chamber	115	41	3
Cold chamber	49	14	9
Plastic Molding Machines	276	38	–
Injection	59	–	–
Compression	217	38	–
Riveting Machines (Not Portable)	1,743	534	204
OTHER SHOP EQUIPMENT	27,815	7,321	2,003
Electric Welding Machines (Not Hand)	6,994	2,016	519
Arc: Motor-generator set	386	427	115
Transformer	584	67	141
Automatic and other	555	104	10
Resistance: Spot	2,790	785	206
Projection	1,032	227	10
Seam	978	232	3
Butt	392	122	17
Butt and flash	277	52	15
Gas Welding, Cutting Machines (Not Hand)	209	52	10
Flame cutting	109	22	10
Welding	100	20	–
Balancing Machines	1,334	399	113
Air Compressors	780	214	73
Plating Equipment	879	169	55
Machines	218	45	12
Tanks	507	96	29
Barrels	154	28	14
Materials Heating Equipment	2,833	717	226
Heat-treating furnaces	1,479	362	107
Stock-heating furnaces	224	58	48
Salt baths	110	24	5
Induction heating units	180	3	–
Baking and drying ovens	812	265	58
Flame hardening	28	5	8
Cleaning Equipment	3,568	705	331
Tumbling barrels	859	187	219
Shot and abrasive blast	354	81	24
Parts washing machines	865	134	70
Pickling machines	199	43	3
Tanks	1,291	260	15
Cranes, Overhead Traveling	690	170	178
Hoists (Incl. Jib and Rail Mounting)	6,552	1,797	414
Chain, hand	2,992	960	136
Electric	3,018	678	260
Pneumatic	542	159	18
Industrial Trucks	4,976	1,382	184
Lift	3,299	1,060	130
Truck-tractor	654	139	48
Powered hand trucks	690	151	6
Crane	133	32	–

Electrical Equipment

1798 plants, 782,546 employees
(In plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**161,914**	**37%**	**18%**
Metal Forming	**52,866**	**43**	**21**
Other Equip.	**87,913**	**29**	**10**
Total	**302,693**	**36**	**16**



Wiring; instruments; motors and generators; transformers; switchboard apparatus; welding apparatus; electrical equipment for transport equipment; lamps; radios, television sets, phonographs, and transmitting equipment; telephone and telegraph equipment; other communications equipment. (Standard Industrial Classification No. 361, 364, 365, 366, 369)

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	161,914	29,872	29,486
Boring Machines	4,670	848	925
Horizontal boring, drilling, and milling	1,126	259	181
Vertical boring mills including vertical turret lathes	1,752	260	629
Precision, horizontal and vertical	688	117	5
Jig boring, horizontal and vertical	896	172	70
Other	208	40	40
Broaching Machines	759	114	86
Horizontal internal	237	31	34
Horizontal surface	52	5	17
Vertical internal	204	36	7
Vertical surface	183	21	14
Other	83	21	14
Contour sawing and filing	904	141	103
Cutoff Machines	7,972	1,395	918
Bandsaw	2,656	325	266
Abrasive disk	1,003	145	36
Hacksaws	2,657	661	315
Rotary, hot or cold	775	115	162
Other	881	149	139
Drilling Machines	39,490	7,145	7,363
Sensitive	9,958	1,286	1,820
Upright: Single-spindle	14,605	2,720	2,081
Gang	8,121	1,876	2,028
Radial	2,771	523	614
Multi-spindle cluster, adjustable & fixed center	1,069	170	193
Unit head and way type, multi-spindle	785	226	85
Deep-hole drills	193	35	67
Other	1,988	309	475
Gear Cutting and Finishing Machines	1,922	211	424
Hobbing machines	1,013	99	301
Shapers, gear	426	40	50
Cutters, form-milling type	150	33	57
Bevel gear cutters (not planer)	86	5	9
Cutters, planer type	–	–	–
Grinders, gear	43	5	5
Shavers, gear	36	–	–
Burnishing and lapping	29	22	–
Chamfering, tooth pointing, tooth rounding	12	–	–
Other	127	7	2
Gear Checking Machines	306	12	7
Grinding Machines	30,092	5,007	4,601
External cylindrical, plain and universal	3,343	691	535
Internal cylindrical	1,010	199	142
Centerless: External	507	111	50
Internal	20	3	2
Surface: Rotary table type	1,203	201	231
Reciprocating type	4,415	767	472
Disk, horizontal and vertical	1,986	259	443
Tool and cutter	5,583	946	918
Bench, floor-stand, and snag	8,387	1,326	1,403
Abrasive belt (not polishing)	1,711	209	34
Other	1,927	295	351
Honing and Lapping	1,070	123	31
Honing	535	51	5
Lapping: External	86	–	–
Internal	235	42	2
Surface	214	30	24
Lathes	41,071	8,609	8,482
Bench and floor, light-duty	11,124	2,291	1,773
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	11,254	2,260	3,362
Turret lathes: Ram type and hand screw	5,566	1,273	815
Saddle type	1,974	437	314
Automatic chucking, horizontal and vertical	1,527	274	288
Automatic between centers chucking	82	27	–
Automatic screw machines, bar	8,024	1,668	1,377
Gun and shaft boring	34	–	19
Other	1,486	359	534
Milling Machines	15,560	2,935	3,046
Bench type	1,027	200	146
Hand	2,332	378	659
Knee-type, horizontal	5,537	1,377	1,366
Vertical	3,369	581	481
Automatic and manufacturing	1,447	123	72
Bed (Lincoln) type, incl automatic rise and fall	303	43	28
Planer type	283	36	81
Die sinkers (except engraving) & duplicators	263	42	24
Other	999	155	179
Planers	594	122	334
Double housing	354	36	239
Openside	139	64	44
Other	101	22	51
Pipe Cutting and Threading Machines	912	201	151
Polishing and Buffing Machines	5,785	1,039	713
Speed lathes	1,599	372	396
Polishing stands	2,853	308	215
Abrasive belt	1,214	315	85
Other	119	44	17
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	3,549	842	1,208
Horizontal	2,653	695	833
Vertical, including slotters	606	101	242
Keyseaters	290	46	133
Threading (except pipe)	4,733	714	792
Tapping	3,198	411	327
Hobbing and milling	588	73	272
Die type	256	29	50
Grinders, thread	237	2	2
Rolling machines, thread	383	82	110
Other	71	17	31
Other Machine Tools	2,525	414	302
METAL FORMING MACHINERY	52,866	11,766	11,003
Bending and Forming Machines	3,211	792	530
Bending rolls, sheet and plate	959	252	237
Bending rolls, bars and shapes	133	33	31
Power bending brakes	978	260	100
Rotary forming machines	204	79	21
Bending machines, pipe and bar	243	62	29
Other	694	107	112
Hydraulic Presses	5,087	726	1,210
Vertical, single action	4,338	647	1,042
Vertical, double and triple action	406	32	57
Horizontal	162	38	66
Other (including hydro-pneumatic)	181	9	45
Pneumatic Presses (except hydro-pneumatic)	913	47	45
Mechanical Presses, Power Driven	24,806	6,258	6,729
Inclinable	13,385	2,893	3,181
Vertical, C-frame	3,224	1,195	949
Vertical, straight-sided	3,917	1,186	1,199
Dieing machines	384	103	76
Horizontal	65	12	14
Other	3,831	869	1,310
Punching and Shearing Machines	5,375	1,491	1,169
Punching machines	1,464	719	167
Plate and sheet shears	2,085	430	445
Bar and angle shears	363	159	88
Rotary shears	309	76	95
Other	1,154	207	374
Forging Machinery (except presses)	552	97	230
Hammers, steam or air	136	31	79
Hammers, gravity drop	129	17	40
Hammers, helve	92	32	26
Forging machines (headers) and rolls	83	12	52
Other	112	5	33
Swaging Machines	356	84	70
Wire and Strip Forming Machines	1,792	584	467
Die Casting Machines	547	67	29
Hot chamber	442	57	19
Cold chamber	105	10	10
Plastic Molding Machines	2,613	445	150
Injection	280	5	–
Compression	2,333	440	150
Riveting Machines (Not Portable)	7,614	1,174	374
OTHER SHOP EQUIPMENT	87,913	17,039	8,543
Electric Welding Machines (Not Hand)	21,146	5,348	553
Arc: Motor-generator set	3,188	694	195
Transformer	2,697	501	76
Automatic and other	484	29	7
Resistance: Spot	12,961	3,718	211
Projection	292	189	5
Gun	118	13	–
Seam	209	44	7
Butt and flash	697	160	52
Gas Welding, Cutting Machines (Not Hand)	909	193	48
Flame cutting	652	139	36
Welding	257	54	12
Balancing Machines	611	117	95
Air Compressors	3,878	882	243
Plating Equipment	8,601	1,373	125
Machines	471	93	24
Tanks	6,544	896	65
Barrels	1,586	384	36
Materials Heating Equipment	14,088	2,761	1,319
Heat-treating furnaces	4,592	1,043	432
Stock-heating furnaces	1,862	276	350
Salt baths	394	72	14
Induction heating units	1,357	36	2
Baking and drying ovens	5,829	1,325	504
Flame hardening	54	9	17
Cleaning Equipment	7,069	1,489	556
Tumbling barrels	2,045	376	320
Shot and abrasive blast	961	132	133
Parts washing machines	1,265	745	51
Pickling machines	96	17	2
Tanks	2,702	219	50
Cranes, Overhead Traveling	4,708	355	2,464
Hoists (Incl. Jib and Rail Mounting)	17,421	3,623	2,659
Chain, hand	5,908	1,880	549
Electric	10,939	1,625	2,070
Pneumatic	574	118	40
Industrial Trucks	9,482	898	481
Lift	6,211	715	409
Truck-tractor	1,554	110	57
Powered hand trucks	1,494	45	5
Crane	223	28	10

Miscellaneous Machine Parts and Jobbing

511 plants, 159,334 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	100,847	41%	14%
Metal Forming	13,090	52	19
Other Equip.	35,674	32	8
Total	149,611	40	13

Valves and fittings (except plumbers'); pipe and fittings fabricated from purchased pipe; ball and roller bearings; machine shops (jobbing, repair, and experimental not elsewhere classified). (Standard Industrial Classification No. 359)

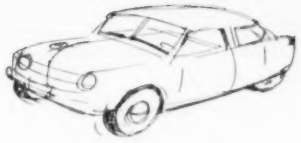
	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	100,847	26,493	14,567
Boring Machines	2,868	862	595
Horizontal boring, drilling, and milling	1,118	403	236
Vertical boring mills including vertical turret lathes	1,026	330	321
Precisions, horizontal and vertical	165	55	–
Jig boring, horizontal and vertical	357	37	18
Other	202	37	18
Broaching Machines	366	100	55
Horizontal internal	220	73	55
Horizontal surface	37	–	–
Vertical internal	27	9	–
Vertical surface	82	18	–
Other	–	–	–
Contour sawing and filing	275	37	–
Cutoff Machines	4,745	797	778
Bandsaw	1,365	174	55
Abrasive disk	586	64	9
Hacksaws	1,722	431	293
Rotary, hot or cold	238	27	64
Other	834	101	357
Drilling Machines	18,310	4,506	2,559
Sensitive	2,601	779	96
Upright: Single-spindle	8,391	1,887	870
Gang	3,682	1,081	925
Radial	1,713	531	357
Multi-spindle cluster, adjustable & fixed center	760	110	127
Unit head and way type, multi-spindle	824	82	55
Deep-hole drills	55	18	–
Other	284	18	119
Gear Cutting and Finishing Machines	696	210	284
Hobbing machines	256	64	73
Shapers, gear	211	82	73
Cutters, form-milling type	156	46	101
Bevel gear cutters (not planer)	9	9	–
Cutters, planer type	64	9	37
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	9	–	–
Grinding Machines	26,062	7,377	2,100
External cylindrical, plain and universal	3,197	870	412
Internal cylindrical	2,217	311	238
Centerless: External	3,811	1,275	165
Internal	321	150	12
Surface: Rotary table	952	229	73
Reciprocating type	1,814	330	110
Disk, horizontal and vertical	1,722	459	27
Tool and cutter	2,977	568	321
Bench, floor stand, and snag	4,250	1,310	385
Abrasive belt (not polishing)	989	101	64
Other	3,811	1,277	293
Honing and Lapping	3,573	815	110
Honing	1,356	403	–
Lapping: External	1,090	348	110
Internal	724	64	–
Surface	403	–	–
Lathes	25,117	6,989	4,102
Bench and floor, light-duty	4,241	1,108	412
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	8,409	2,721	2,427
Turret lathes: Ram type and hand screw	4,351	925	641
Saddle type	1,145	284	211
Automatic chucking, horizontal and vertical	1,292	403	82
Automatic between centers chucking	27	–	–
Automatic screw machines, bar	5,389	1,548	256
Gun and shaft boring	–	–	–
Other	266	–	73
Milling Machines	7,676	1,933	1,310
Bench type	469	174	18
Hand	1,282	183	238
Knee-type, horizontal	2,821	916	605
Vertical	1,466	266	174
Automatic and manufacturing	568	82	46
Bed (Lincoln-type, incl automatic rise and fall)	540	137	92
Planer type	137	37	64
Die sinkers (except engraving) & duplicators	147	46	18
Other	266	92	55
Planers	1,036	293	650
Double housing	824	238	540
Openside	147	37	73
Other	55	18	37
Pipe Cutting and Threading Machines	623	293	64
Polishing and Buffing Machines	3,828	742	604
Speed lathes	2,418	394	531
Polishing stands	806	183	55
Abrasive belt	577	165	9
Other	27	–	9
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	2,373	770	724
Horizontal	1,786	531	595
Vertical, including slotters	266	92	37
Keyseaters	321	147	92
Threading (except pipe)	1,870	513	183
Tapping	687	202	82
Hobbing and milling	211	55	37
Die type	403	110	46
Grinders, thread	147	–	–
Rolling machines, thread	92	9	–
Other	330	137	18
Other Machine Tools	1,420	256	449
METAL FORMING MACHINERY	13,090	4,339	2,464
Bending and Forming Machines	1,394	403	358
Bending rolls, sheet and plate	495	147	183
Bending rolls, bars and shapes	147	64	18
Power bending brakes	284	73	37
Rotary forming machines	110	27	37
Bending machines, pipe and bar	211	37	46
Other	147	55	37
Hydraulic Presses	1,741	403	330
Vertical, single action	1,310	275	202
Vertical, double and triple action	119	37	18
Horizontal	211	73	92
Other (including hydro-pneumatic)	101	18	18
Pneumatic Presses (except hydro-pneumatic)	82	–	–
Mechanical Presses, Power Driven	6,338	2,454	1,007
Inclinable	4,195	1,557	568
Vertical, C-frame	357	174	101
Vertical, straight-sided	1,264	458	311
Dieing machines	27	18	–
Horizontal	64	55	–
Other	431	192	27
Punching and Shearing Machines	1,026	367	229
Punching machines	238	110	92
Plate and sheet shears	440	92	55
Bar and angle shears	174	101	27
Rotary shears	137	64	37
Other	37	–	18
Forging Machinery (except presses)	888	356	146
Hammers, steam or air	101	27	64
Hammers, gravity drop	46	18	27
Hammers, helve	73	9	–
Forging machines (headers) and rolls	650	293	46
Other	18	9	9
Swaging Machines	220	18	92
Wire and Strip Forming Machines	73	27	–
Die Casting Machines	348	64	46
Hot chamber	330	64	46
Cold chamber	18	–	–
Plastic Molding Machines	64	55	–
Injection	9	–	–
Compression	55	55	–
Riveting Machines (Not Portable)	916	192	256
OTHER SHOP EQUIPMENT	35,674	8,580	2,968
Electric Welding Machines (Not Hand)	4,212	823	82
Arc: Motor-generator set	2,024	522	46
Transformer	1,218	128	9
Automatic and other	284	18	–
Resistance: Spot	568	128	18
Projection	18	–	–
Gun	9	–	–
Seam	9	–	–
Butt and flash	82	27	9
Gas Welding, Cutting Machines (Not Hand)	1,145	247	–
Flame cutting	788	192	–
Welding	357	55	–
Balancing Machines	302	73	27
Air Compressors	1,969	522	202
Plating Equipment	421	119	18
Machines	73	18	–
Tanks	238	64	–
Barrels	110	37	18
Materials Heating Equipment	5,422	1,392	403
Heat-treating furnaces	4,269	1,227	348
Stock-heating furnaces	128	46	37
Salt baths	696	92	18
Induction heating units	137	–	–
Baking and drying ovens	119	18	–
Flame hardening	73	9	–
Cleaning Equipment	5,331	1,328	550
Tumbling barrels	3,215	870	440
Shot and abrasive blast	431	64	18
Parts washing machines	1,090	284	55
Pickling machines	82	–	–
Tanks	513	110	37
Cranes, Overhead Traveling	1,163	357	165
Hoists (Incl. Jib and Rail Mounting)	12,448	3,142	981
Chain, hand	6,641	2,116	834
Electric	5,560	916	101
Pneumatic	247	110	46
Industrial Trucks	3,261	577	540
Lift	2,024	357	531
Truck-tractor	284	55	–
Powered hand trucks	577	55	9
Crane	376	110	–

Motor Vehicles and Parts

943 plants, 667,335 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**138,595**	**56%**	**28%**
Metal Forming	**42,382**	**68**	**38**
Other Equip.	**68,286**	**37**	**12**
Total	**249,263**	**53**	**26**

Ambulances, fire engines, hearses, motor buses, passenger cars, taxicabs, trucks, truck tractors; passenger-car, truck, and bus bodies; engines and parts; brakes, clutches, axles, radiators, transmissions, wheels, and parts not elsewhere classified. (Standard Industrial Classification No. 371)



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	**138,595**	**38,366**	**39,498**
Boring Machines	**4,019**	**1,226**	**442**
Horizontal boring, drilling, and milling	975	290	164
Vertical boring mills including vertical turret lathes	658	216	127
Precision, horizontal and vertical	1,497	389	58
Jig boring, horizontal and vertical	297	83	61
Other	592	248	32
Broaching Machines	**2,608**	**1,101**	**345**
Horizontal Internal	668	262	187
Horizontal surface	138	62	9
Vertical internal	386	147	67
Vertical surface	1,043	424	72
Other	373	206	10
Contour sawing and filing	173	14	112
Cutoff Machines	**3,682**	**859**	**757**
Bandsaw	1,290	262	251
Abrasive disk	437	110	52
Hacksaws	1,044	255	211
Rotary, hot or cold	601	147	152
Other	310	85	91
Drilling Machines	**33,079**	**8,412**	**12,217**
Sensitive	4,444	673	2,468
Upright: Single-spindle	8,106	1,604	3,641
Gang	10,621	3,082	3,866
Radial	1,882	403	622
Multi-spindle cluster, adjustable & fixed center	2,259	709	507
Unit head and way type, multi-spindle	2,221	589	556
Deep-hole drills	159	69	10
Other	3,387	1,283	547
Gear Cutting and Finishing Machines	**8,689**	**3,414**	**1,956**
Hobbing machines	2,805	1,083	667
Shapers, gear	1,920	523	792
Cutters, form-milling type	80	14	56
Bevel gear cutters (not planer)	1,689	737	279
Cutters, planer type	–	–	–
Grinders, gear	130	55	6
Shavers, gear	809	282	13
Burnishing and lapping	659	368	80
Chamfering, tooth pointing, tooth rounding	550	324	52
Other	47	28	11
Gear Checking Machines	**481**	**105**	**102**
Grinding Machines	**33,251**	**9,001**	**8,585**
External cylindrical, plain and universal	6,962	1,712	1,914
Internal cylindrical	2,249	546	483
Centerless: External	2,691	767	434
Internal	334	121	21
Surface: Rotary table type	1,488	384	297
Reciprocating type	2,410	592	587
Disk, horizontal and vertical	1,106	366	291
Tool and cutter	9,985	2,416	3,026
Bench, floorstand, and snag	2,642	716	784
Abrasive belt (not polishing)	89	6	3
Other	3,292	1,375	745
Honing and Lapping	**1,882**	**618**	**150**
Honing	678	206	32
Lapping: External	151	38	24
Internal	503	201	43
Surface	550	173	51
Lathes	**23,415**	**6,178**	**6,889**
Bench and floor, light-duty	1,463	330	413
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	8,618	2,516	2,584
Turret lathes: Ram type and hand screw	2,480	513	795
Saddle type	622	137	203
Automatic chucking, horizontal and vertical	4,186	1,163	1,223
Automatic between centers chucking	555	126	104
Automatic screw machines, bar	4,277	1,002	1,228
Gun and shaft boring	–	–	–
Other	1,214	391	339
Milling Machines	**11,063**	**2,728**	**3,494**
Bench type	99	22	27
Hand	1,875	461	696
Knee-type, horizontal	2,461	527	973
Vertical	1,369	290	348
Automatic and manufacturing	1,843	409	530
Bed (Lincoln) type, incl automatic rise and fall	1,275	363	323
Planer type	108	33	37
Die sinkers (except engraving) & duplicators	166	44	48
Other	1,867	579	512
Planers	**417**	**98**	**207**
Double housing	257	52	149
Openside	152	43	57
Other	8	3	1
Pipe Cutting and Threading Machines	**568**	**136**	**147**
Polishing and Buffing Machines	**8,326**	**2,355**	**1,806**
Speed lathes	2,201	569	634
Polishing stands	3,987	1,057	886
Abrasive belt	677	173	55
Other	1,461	556	231
Rifle Working Machines (not deep-hole drills)	**4**	**1**	**–**
Shapers	**2,008**	**541**	**822**
Horizontal	1,612	456	645
Vertical, including slotters	273	56	117
Keyseaters	123	29	60

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	3,344	986	1,095
Tapping	1,937	658	584
Hobbing and milling	263	66	67
Die type	544	170	220
Grinders, thread	188	8	5
Rolling machines, thread	401	61	216
Other	11	3	3
Other Machine Tools	**1,586**	**615**	**372**
METAL FORMING MACHINERY	**42,382**	**12,807**	**15,995**
Bending and Forming Machines	**3,471**	**1,112**	**859**
Bending rolls, sheet and plate	826	274	213
Bending rolls, bars and shapes	493	151	15
Power bending brakes	564	151	145
Rotary forming machines	188	41	91
Bending machines, pipe and bar	124	19	25
Other	1,276	476	370
Hydraulic Presses	**1,383**	**486**	**108**
Vertical, single action	932	309	83
Vertical, double and triple action	41	8	3
Horizontal	65	10	18
Other (including hydro-pneumatic)	345	159	4
Pneumatic Presses (except hydro-pneumatic)	**189**	**15**	**44**
Mechanical Presses, Power Driven	**26,666**	**7,338**	**12,013**
Inclinable	8,928	2,635	3,726
Vertical, C-frame	5,930	1,488	3,291
Vertical, straight-sided	7,852	2,134	3,299
Dieing machines	62	53	–
Horizontal	636	191	235
Other	3,258	837	1,462
Punching and Shearing Machines	**4,309**	**1,541**	**1,481**
Punching machines	2,450	958	794
Plate and sheet shears	1,234	315	502
Bar and angle shears	150	51	48
Rotary shears	85	24	63
Other	390	193	94
Forging Machinery (except presses)	**1,765**	**462**	**800**
Hammers, steam or air	785	225	349
Hammers, gravity drop	102	19	55
Hammers, helve	50	13	18
Forging machines (headers) and rolls	507	89	295
Other	321	116	83
Swaging Machines	**140**	**67**	**24**
Wire and Strip Forming Machines	**439**	**130**	**157**
Die Casting Machines	**435**	**151**	**64**
Hot chamber	330	109	42
Cold chamber	105	42	22
Plastic Molding Machines	**242**	**61**	**23**
Injection	44	18	1
Compression	198	43	22
Riveting Machines (Not Portable)	**3,343**	**1,444**	**422**
OTHER SHOP EQUIPMENT	**68,286**	**16,933**	**8,336**
Electric Welding Machines (Not Hand)	**18,012**	**5,341**	**1,975**
Arc: Motor-generator set	5,100	1,412	333
Transformer	1,229	362	8
Automatic and other	1,429	562	93
Resistance: Spot	5,944	2,254	1,193
Projection	1,469	591	166
Gun	512	37	1
Seam	178	51	32
Butt and flash	2,151	272	149
Gas Welding, Cutting Machines (Not Hand)	**218**	**52**	**6**
Flame cutting	182	38	6
Welding	36	14	–
Balancing Machines	**1,234**	**519**	**230**
Air Compressors	**744**	**206**	**124**
Plating Equipment	**2,308**	**899**	**317**
Machines	76	42	1
Tanks	1,848	643	295
Barrels	376	214	21
Materials Heating Equipment	**8,040**	**2,384**	**1,278**
Heat-treating furnaces	5,616	1,510	992
Stock-heating furnaces	717	282	115
Salt baths	224	97	14
Induction heating units	278	1	139
Baking and drying ovens	1,188	491	18
Flame hardening	17	3	–
Cleaning Equipment	**7,015**	**1,995**	**872**
Tumbling barrels	1,334	376	314
Shot and abrasive blast	630	172	21
Parts washing machines	2,278	641	169
Pickling machines	435	135	21
Tanks	2,338	671	347
Cranes, Overhead Traveling	**3,196**	**681**	**1,243**
Hoists (Incl. Jib and Rail Mounting)	**19,735**	**3,406**	**1,978**
Chain, hand	5,950	1,096	422
Electric	12,772	2,003	1,303
Pneumatic	1,013	307	253
Industrial Trucks	**7,792**	**1,450**	**313**
Lift	4,644	1,159	65
Truck-tractor	1,455	231	167
Powered hand trucks	1,490	46	73
Crane	183	24	8

Aircraft and Parts

218 plants, 277,268 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**54,711**	**16%**	**2%**
Metal Forming	**8,013**	**13**	**1**
Other Equip.	**17,312**	**7**	**0.2**
Total	**80,036**	**14**	**2**

Aircraft; aircraft engines and parts; propellers and parts; aircraft parts and auxiliary equipment not elsewhere classified; repair work on aircraft and engines. (Standard Industrial Classification No. 372)

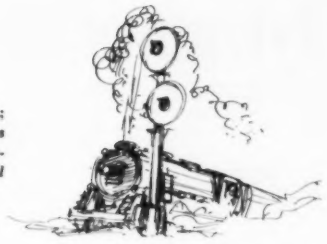
	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	54,711	7,719	1,094
Boring Machines	2,214	218	24
Horizontal boring, drilling, and milling	389	37	5
Vertical boring mills including vertical turret lathes	602	39	9
Precision, horizontal and vertical	804	78	4
Jig boring, horizontal and vertical	274	39	2
Other	145	7	4
Broaching Machines	346	35	7
Horizontal internal	110	18	3
Horizontal surface	34	–	–
Vertical internal	57	4	–
Vertical surface	138	11	–
Other	7	2	2
Contour sawing and filing	485	14	–
Cutoff Machines	2,791	384	43
Bandsaw	1,442	164	23
Abrasive disk	372	18	2
Hacksaws	503	76	16
Rotary, hot or cold	253	89	–
Other	221	35	2
Drilling Machines	11,135	1,646	289
Sensitive	3,501	545	32
Upright: Single-spindle	3,202	503	96
Gang	1,634	242	23
Radial	1,159	117	42
Multiple-spindle cluster, adjustable & fixed center	443	115	18
Unit head and way type, multi-spindle	159	16	16
Deep-hole drills	143	25	5
Other	494	83	5
Gear Cutting and Finishing Machines	1,716	140	12
Hobbing machines	212	27	1
Shapers, gear	110	51	5
Cutters, form-relieving type	16	–	–
Bevel gear cutters (not planer)	140	11	–
Cutters, planer type	21	5	–
Grinders, gear	455	27	–
Shavers, gear	104	–	–
Burnishing and lapping	133	19	–
Chamfering, tooth pointing, tooth rounding	23	–	–
Other			
Gear Checking Machines	358	18	2
Grinding Machines	14,820	2,173	159
External cylindrical, plain and universal	2,096	276	39
Internal cylindrical	1,383	184	18
Centerless: External	18	1	2
Internal	154	32	–
Surface: Rotary table type	576	129	5
Reciprocating type	1,731	96	4
Disk, horizontal and vertical	1,460	133	11
Tool and cutter	2,381	398	44
Bench, floor-stand, and snag	2,844	641	28
Abrasive belt (not polishing)	529	48	2
Other	648	42	4
Honing and Lapping	742	72	–
Honing	345	35	–
Lapping: External	165	7	–
Internal	112	18	–
Surface	120	12	–
Lathes	8,783	1,359	290
Brass and floor, light-duty	959	104	10
Engine, heavy-duty, incl toolrm, mfg, nut form, gap	3,140	542	131
Turret lathes: Ram type and hand screw	1,214	358	80
Saddle type	503	65	41
Automatic chucking, horizontal and vertical	720	99	5
Automatic between centers chucking	265	23	11
Automatic screw machines, bar	772	110	19
Gun and shaft boring	4	–	–
Other	186	60	5
Milling Machines	5,969	802	143
Bench type	147	32	2
Hand	547	92	12
Knee-type, horizontal	2,129	358	85
Vertical	1,428	159	25
Automatic and manufacturing	612	35	11
Bed (Lincoln) type, incl automatic rise and fall	321	72	4
Planer type	106	20	4
Die sinkers (except engraving) & duplicators	278	34	–
Other	425	50	–
Planers	195	56	13
Double housing	40	9	9
Openside	58	5	2
Other	7	2	2
Pipe Cutting and Threading Machines	129	16	–
Polishing and Buffing Machines	2,719	533	46
Speed lathes	704	131	14
Polishing stands	1,756	294	25
Abrasive belt	463	62	
Other	444	46	7
Rifle Rorking Machines (not deep-hole drills)	–	–	–
Shapers	635	102	41
Horizontal	497	76	30
Vertical, including slotters	110	21	7
Keyseaters	28	5	2
Threading (except pipe)	1,114	106	7
Tapping	428	21	–
Hobbing and milling	269	42	5
Die type	28	2	–
Grinders, thread	320	34	2
Rolling machines, thread	28	–	–
Other	41	2	–
Other Machine Tools	650	85	18
METAL FORMING MACHINERY	8,013	933	89
Bending and Forming Machines	1,541	186	21
Bending rolls, sheet and plate	285	40	4
Bending rolls, bars and shapes	140	19	4
Power bending brakes	379	74	4
Rotary forming machines	127	9	–
Bending machines, pipe and bar	260	19	2
Other	350	25	7
Hydraulic Presses	731	73	11
Vertical, single action	359	44	7
Vertical, double and triple action	71	5	–
Horizontal	32	–	–
Other (including hydro-pneumatic)	69	4	4
Pneumatic Presses (except hydro-pneumatic)	110	19	–
Mechanical Presses, Power Driven	1,404	236	26
Inclinable	687	191	5
Vertical, C-frame	198	22	16
Vertical, straight-sided	186	18	–
Boring machines	14	–	–
Horizontal	4	4	–
Other	135	11	5
Punching and Shearing Machines	1,446	185	27
Punching machines	448	48	9
Plate and sheet shears	634	92	16
Bar and angle shears	40	9	–
Rotary shears	96	9	2
Other	228	27	–
Forging Machinery (except presses)	575	128	2
Hammers, steam or air	235	27	12
Hammers, gravity drop	173	42	–
Hammers, helve	11	–	–
Forging machines (headers) and rolls	44	19	–
Other	112	20	–
Swaging Machines	120	9	–
Wire and Strip Forming Machines	64	2	–
Die Casting Machines	24	–	–
Hot chamber	9	–	–
Cold chamber	15	–	–
Plastic Molding Machines	23	2	–
Injection	5	–	–
Compression	18	2	–
Riveting Machines (Not Portable)	1,975	93	2
OTHER SHOP EQUIPMENT	17,312	1,109	31
Electric Welding Machines (Not Hand)	2,296	186	2
Arc: Motor-generator set	1,184	113	–
Transformer	185	11	–
Automatic and other	110	2	–
Resistance: Spot	584	11	–
Projection	16	13	–
Seam	42	–	–
Butt and flash	73	–	–
Gas Welding, Cutting Machines (Not Hand)	102	16	2
Flame cutting	181	9	–
Welding	77	9	–
Balancing Machines	64	–	–
Air Compressors	226	9	11
Plating Equipment	476	99	5
Machines	1,417	52	–
Tanks	90	–	–
Barrels	1,228	48	–
Materials Heating Equipment	99	4	–
Heat-treating furnaces	2,183	196	9
Stock-heating furnaces	1,327	141	7
Salt baths	181	7	–
Induction heating units	165	15	–
Baking and drying ovens	135	–	–
Flame hardening	311	13	2
Cleaning Equipment	64	–	–
Tumbling barrels	2,084	177	4
Shot and abrasive blast	236	5	
Parts washing machines	388	31	4
Pickling machines	496	22	–
Tanks	33	–	–
Cranes, Overhead Traveling	931	119	
Hoists (Incl. jib and Rail Mounting)	830	12	–
Chain, hand	5,717	293	–
Electric	2,943	156	–
Pneumatic	2,546	93	–
Industrial Trucks	228	44	–
Lift	1,940	76	–
Truck-tractor	1,100	56	–
Powered hand trucks	286	12	–
Crane	471		–
	83	6	–

Railroad Equipment

90 plants, 86,748 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**16,075**	**48%**	**29%**
Metal Forming	**4,629**	**62**	**43**
Other Equip.	**14,201**	**40**	**25**
Total	**34,905**	**47**	**29**

Locomotives; railroad and street cars; electric, diesel, and gasoline engines for locomotion; repair work on locomotives and cars. (Standard Industrial Classification No. 374)



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	16,075	3,048	4,719
Boring Machines	1,060	142	365
Horizontal boring, drilling, and milling	403	43	189
Vertical boring mills including vertical turret lathes	415	70	158
Precision, horizontal and vertical	136	8	–
Jig boring, horizontal and vertical	40	3	3
Other	66	18	15
Broaching Machines	82	10	18
Horizontal internal	40	5	18
Horizontal surface	–	–	–
Vertical internal	10	–	–
Vertical surface	32	5	–
Other	–	–	–
Contour sawing and filing	63	12	8
Cutoff Machines	891	162	183
Bandsaw	325	63	53
Abrasive disk	116	17	3
Hacksaws	291	60	58
Rotary, hot or cold	141	20	56
Other	18	2	13
Drilling Machines	2,981	650	787
Sensitive	561	116	68
Upright: Single-spindle	634	169	259
Gang	583	116	88
Radial	958	214	297
Multi-spindle cluster, adjustable & fixed center	93	8	32
Unit head and way type, multi-spindle	27	5	–
Deep-hole drills	15	2	3
Other	110	18	20
Gear Cutting and Finishing Machines	133	7	72
Hobbing machines	65	7	28
Shapers, gear	27	–	17
Cutters, form-milling type	20	–	17
Bevel gear cutters (not planer)	5	–	2
Cutters, planer type	3	–	3
Grinders, gear	5	–	5
Shavers, gear	5	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	3	–	–
Gear Checking Machines	22	2	2
Grinding Machines	3,820	864	1,007
External cylindrical, plain and universal	312	48	58
Internal cylindrical	226	101	28
Centerless: External	178	23	10
Internal	16	4	1
Surface: Rotary table type	85	17	13
Reciprocating type	342	61	22
Disk, horizontal and vertical	156	40	55
Tool and cutter	1,051	206	134
Bench, floor stand, and snag	1,190	287	606
Abrasive belt (not polishing)	118	37	25
Other	146	40	55
Honing and Lapping	152	18	2
Honing	76	3	2
Lapping: External	23	5	–
Internal	28	8	–
Surface	25	2	–
Lathes	3,376	626	1,005
Bench and floor, light-duty	221	23	32
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	1,575	262	715
Turret lathes: Ram type and hand screw	802	164	129
Saddle type	189	56	35
Automatic chucking, horizontal and vertical	129	10	3
Automatic between centers chucking	13	–	3
Automatic screw machines, bar	337	81	28
Gun and shaft boring	12	3	–
Other	98	27	60
Milling Machines	1,419	226	330
Bench type	8	–	3
Hand	125	13	45
Knee-type, horizontal	526	85	151
Vertical	355	66	42
Automatic and manufacturing	106	25	13
Bed (Lincoln) type, incl automatic rise and fall	123	10	2
Planer type	63	12	32
Die sinkers (except engraving) & duplicators	25	5	5
Other	88	10	37
Planers	457	33	301
Double housing	377	20	257
Openside	60	13	27
Other	20	–	17
Pipe Cutting and Threading Machines	178	40	60
Polishing and Buffing Machines	348	67	47
Speed lathes	101	17	30
Polishing stands	149	43	12
Abrasive belt	63	5	2
Other	35	2	3
Rifle Boring Machines (not deep-hole drills)	3	–	–
Shapers	619	124	316
Horizontal	370	86	158
Vertical, including slotters	206	28	133
Keyseaters	43	10	25

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	383	48	163
Tapping	158	20	66
Hobbing and milling	22	2	7
Die type	128	10	70
Grinders, thread	22	2	–
Rolling machines, thread	33	7	12
Other	20	7	8
Other Machine Tools	88	17	53
METAL FORMING MACHINERY	4,629	887	2,007
Bending and Forming Machines	742	165	188
Bending rolls, sheet and plate	136	32	50
Bending rolls, bars and shapes	85	20	13
Power bending brakes	262	55	33
Rotary forming machines	68	20	25
Bending machines, pipe and bar	91	13	42
Other	100	25	25
Hydraulic Presses	478	70	207
Vertical, single action	324	42	146
Vertical, double and triple action	81	3	23
Horizontal	61	20	33
Other (including hydro-pneumatic)	12	5	5
Pneumatic Presses (except hydro-pneumatic)	50	2	7
Mechanical Presses, Power Driven:	1,578	414	415
Inclinable	378	91	103
Vertical, C-frame	295	88	53
Vertical, straight-sided	652	176	178
Dieing machines	62	8	3
Horizontal	61	18	30
Other	129	33	48
Punching and Shearing Machines	1,150	187	757
Punching machines	521	70	423
Plate and sheet shears	387	60	178
Bar and angle shears	129	25	96
Rotary shears	70	27	37
Other	43	5	23
Forging Machinery (except presses)	395	33	309
Hammers, steam or air	191	20	153
Hammers, gravity drop	68	5	53
Hammers, helve	30	–	28
Forging machines (headers) and rolls	88	8	60
Other	18	–	15
Swaging Machines	25	2	5
Wire and Strip Forming Machines	13	3	8
Die Casting Machines	2	–	–
Hot chamber	–	–	–
Cold chamber	2	–	–
Plastic Molding Machines	8	3	–
Injection	8	3	–
Compression	–	–	–
Riveting Machines (Not Portable)	188	8	111
OTHER SHOP EQUIPMENT	14,201	2,164	3,535
Electric Welding Machines (Not Hand)	4,965	483	153
Arc: Motor-generator set	2,842	262	40
Transformer	1,272	53	3
Automatic and other	166	10	–
Resistance: Spot	385	98	48
Projection	60	8	–
Gun	55	7	–
Seam	125	20	43
Butt and flash	60	25	13
Gas Welding, Cutting Machines (Not Hand)	202	28	19
Flame cutting	174	26	17
Welding	28	–	2
Balancing Machines	91	15	15
Air Compressors	274	53	106
Plating Equipment	65	5	17
Machines	7	–	3
Tanks	28	–	7
Barrels	30	5	7
Materials Heating Equipment	1,405	321	460
Heat-treating furnaces	465	120	58
Stock-heating furnaces	702	174	378
Salt baths	22	2	3
Induction heating units	45	–	3
Baking and drying ovens	158	23	18
Flame hardening	13	2	–
Cleaning Equipment	448	40	101
Tumbling barrels	141	15	73
Shot and abrasive blast	115	10	23
Parts washing machines	116	10	3
Pickling machines	18	5	–
Tanks	58	–	2
Cranes, Overhead Traveling	1,365	128	1,088
Hoists (Incl. Jib and Rail Mounting)	4,609	963	1,526
Chain, hand	628	67	471
Electric	3,754	811	1,024
Pneumatic	227	85	31
Industrial Trucks	777	128	50
Lift	528	107	29
Truck-tractor	123	12	5
Powered hand trucks	76	2	–
Crane	50	7	16

Fabricated Metal Products

6963 plants, 1,122,894 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**375,717**	**45%**	**23%**
Metal Forming	**196,546**	**60**	**28**
Other Equip.	**227,015**	**35**	**9**
Total	**799,278**	**46**	**20**

Tinware; tools, saws; hardware; plumbers' supplies; oil burners; structural steel; boiler-shop products; sheet-metal work; enameled products, stamped and pressed metal products; powder metallurgy; wirework; springs; screw-machine products; metal furniture, specialties, fixtures; games, toys; jewelry; sporting goods; beer-dispensing equipment. (Standard Industrial Classification No. 2514, 2522, 2523, 2541, 34, 375, 379, 39)

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	375,717	83,324	87,405
Boring Machines	5,178	1,302	1,304
Horizontal boring, drilling, and milling	1,755	520	529
Vertical boring mills, including vertical turret lathes	1,520	375	621
Precision, horizontal and vertical	771	46	35
Jig boring, horizontal and vertical	980	206	92
Other	146	55	17
Broaching Machines	2,470	511	150
Horizontal internal	450	138	77
Horizontal surface	204	137	8
Vertical internal	723	84	51
Vertical surface	374	55	–
Other	313	97	14
Contour sawing and filing	1,610	273	119
Cutoff Machines	21,391	4,844	2,209
Bandsaw	8,204	1,384	569
Abrasive disk	3,073	470	85
Hacksaws	7,265	2,327	1,064
Rotary, hot or cold	1,102	298	239
Other	1,847	385	252
Drilling Machines	80,374	17,463	13,953
Sensitive	12,013	2,453	1,356
Upright: Single-spindle	45,405	10,106	7,259
Gang	7,312	1,590	1,353
Radial	5,378	1,309	1,561
Multi-spindle (automatic & hand center)	2,341	741	744
Unit head and way type, multi-spindle	1,461	255	184
Deep-hole drills	281	86	14
Other	4,183	831	1,082
Gear Cutting and Finishing Machines	1,956	662	403
Hobbing machines	590	164	97
Shapers, gear	772	396	148
Cutters, formmilling type	222	62	101
Bevel gear cutters (not planer)	12	–	6
Cutters, planer type	13	–	–
Grinders, gear	75	–	8
Shavers, gear	58	6	24
Burnishing and lapping	6	3	–
Chamfering, tooth pointing, tooth rounding	26	13	–
Other	182	12	68
Gear Checking Machines	65	–	–
Grinding Machines	70,619	16,826	8,826
External cylindrical, plain and universal	4,840	1,365	597
Internal cylindrical	3,667	357	142
Centerless: External	3,860	426	63
Internal	17	1	2
Surface: Rotary table type	2,615	654	229
Reciprocating type	9,828	2,301	1,042
Disk, horizontal and vertical	2,175	607	361
Tool and cutter	10,819	2,129	1,589
Bench, floorstand, and snag	27,162	7,570	3,747
Abrasive belt (not polishing)	4,921	808	170
Other	4,915	658	876
Honing and Lapping	2,000	493	118
Honing	772	102	8
Lapping: External	161	36	–
Internal	479	45	51
Surface	588	310	59
Lathes	82,502	18,363	23,993
Bench and floor, light-duty	16,504	3,562	3,251
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	12,540	5,812	8,144
Turret lathes: Ram type and hand screw	13,436	2,705	4,268
Saddle type	3,824	1,111	581
Automatic chucking, horizontal and vertical	1,559	398	220
Automatic between centers chucking	401	88	12
Automatic screw machines, bar	19,764	4,229	4,616
Gun and shaft boring	25	17	–
Other	4,409	840	2,891
Milling Machines	32,798	7,083	9,852
Bench type	1,562	354	319
Hand	7,854	1,964	3,323
Knee-type, horizontal	9,806	2,090	2,713
Vertical	5,015	999	686
Automatic and manufacturing	4,319	694	1,061
Bed (Lincoln) type, incl automatic rise and fall	1,059	16	596
Planer type	563	172	222
Die sinkers (except engraving) & duplicators	927	269	181
Other	1,693	385	771
Planers	2,772	682	1,695
Double housing	1,588	381	1,061
Openside	751	207	367
Other	433	94	267
Pipe Cutting and Threading Machines	3,665	1,132	600
Polishing and Buffing Machines	30,469	5,527	6,656
Speed lathes	7,487	1,589	1,281
Polishing stands	14,948	3,112	4,265
Abrasive belt	4,997	674	298
Other	3,037	152	812
Rifle Working Machines (not deep-hole drills)			
Shapers	11,577	3,680	3,861
Horizontal	9,704	3,108	3,298
Vertical, including slotters	1,373	445	372
Keyseaters	500	127	191
Threading (except pipe)	24,264	3,942	13,229
Tapping	7,352	1,176	2,187
Hobbing and milling	591	212	99
Die type	2,427	832	679
Grinders, thread	370	24	–
Rolling machines, thread	3,414	1,028	1,362
Other	10,110	670	8,902
Other Machine Tools	2,007	641	357
METAL FORMING MACHINERY	196,546	62,640	54,942
Bending and Forming Machines	22,879	6,972	4,414
Bending rolls, sheet and plate	5,179	1,681	1,321
Bending rolls, bars and shapes	2,074	488	897
Power bending brakes	7,023	1,759	694
Rotary forming machines	2,970	789	659
Bending machines, pipe and bar	1,920	517	290
Other	3,713	1,738	553
Hydraulic Presses	6,337	1,260	694
Vertical, single action	4,354	974	501
Vertical, double and triple action	564	92	93
Horizontal	539	94	86
Other (including hydro-pneumatic)	680	100	14
Pneumatic Presses (except hydro-pneumatic)	1,289	75	18
Mechanical Presses, Power Driven	108,332	36,707	32,558
Inclinable	59,329	21,770	13,026
Vertical, C-frame	14,584	5,129	5,879
Vertical, straightside	24,793	6,349	10,999
Eyeing machines	868	277	96
Horizontal	736	238	217
Other	8,022	2,944	2,341
Punching and Shearing Machines	23,814	7,275	6,924
Punching machines	8,357	2,656	3,076
Plate and sheet shears	9,316	2,798	1,976
Bar and angle shears	1,975	524	780
Rotary shears	2,573	801	836
Other	1,593	496	256
Forging Machinery (except presses)	8,487	1,928	4,610
Hammers, steam or air	637	151	392
Hammers, gravity drop	2,234	590	1,154
Hammers, helve	793	217	500
Forging machines (headers) and rolls	4,160	673	2,425
Other	663	297	139
Swaging Machines	1,595	651	494
Wire and Strip Forming Machines	9,581	4,020	2,753
Die Casting Machines	785	199	26
Hot chamber	598	114	26
Cold chamber	187	85	–
Plastic Molding Machines	3,780	1,098	301
Injection	1,450	209	–
Compression	2,330	889	301
Riveting Machines (Not Portable)	9,667	2,455	2,150
OTHER SHOP EQUIPMENT	227,015	58,279	21,079
Electric Welding Machines (Not Hand)	48,959	11,597	2,596
Arc: Motor-generator set	19,030	4,614	501
Transformer	6,192	538	67
Automatic and other	2,631	770	192
Resistance: Spot	15,469	4,169	1,498
Projection	1,238	300	12
Gun	1,420	180	51
Seam	978	253	25
Butt and flash	2,001	773	250
Gas Welding, Cutting Machines (Not Hand)	5,242	1,179	83
Flame cutting	3,464	733	26
Welding	1,778	446	57
Balancing Machines	674	137	23
Air Compressors	13,864	3,221	1,759
Plating Equipment	19,576	5,367	1,260
Machines	1,712	327	250
Tanks	12,025	3,256	653
Barrels	5,839	1,784	357
Materials Heating Equipment	25,517	7,374	3,138
Heat-treating furnaces	12,687	3,868	1,422
Stock-heating furnaces	3,973	1,332	911
Salt baths	1,988	530	178
Induction heating units	1,712	596	–
Baking and drying ovens	5,355	1,541	589
Flame hardening	490	67	38
Cleaning Equipment	32,916	9,246	4,636
Tumbling barrels	17,903	5,948	3,973
Shot and abrasive blast	2,288	656	227
Parts washing machines	3,394	487	118
Pickling machines	487	121	6
Tanks	8,844	2,034	312
Cranes, Overhead Traveling	8,201	1,982	2,499
Hoists (Incl. Jib and Rail Mounting)	48,634	12,940	4,136
Chain, hand	20,916	7,727	1,710
Electric	25,190	4,305	2,186
Pneumatic	2,528	908	240
Industrial Trucks	23,432	5,236	949
Lift	17,226	4,379	722
Truck-tractor	2,414	591	173
Powered hand trucks	2,823	276	–
Crane	969	198	54

Shipbuilding, Ordnance and Miscellaneous

2481 plants, 784,754 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**240,713**	**36%**	**18%**
Metal Forming	**49,701**	**45**	**27**
Other Equip.	**164,957**	**36**	**14**
Total	**455,371**	**37**	**18**

Shipbuilding, repairs; forgings; foundry products; die castings; pipe fabrication; ordnance and accessories, including rifles, small arms, guns and gun carriages, ammunition, fuses, explosives, fire-control instruments, tanks; steam engines, turbines; water wheels and turbines. (Standard Industrial Classification No. 19, 332, 336, 3391, 3393, 351, 373)

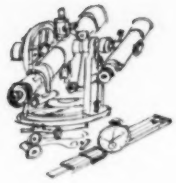
	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	240,713	44,208	44,132
Boring Machines	12,471	2,041	3,225
Horizontal boring, drilling, and milling	3,616	729	772
Vertical boring mills including vertical turret lathes	5,850	962	2,042
Precision, horizontal and vertical	1,052	75	30
Jig boring, horizontal and vertical	433	90	22
Other	1,520	185	359
Broaching Machines	1,604	385	105
Horizontal internal	482	72	75
Horizontal surface	111	13	–
Vertical internal	113	6	4
Vertical surface	787	287	17
Other	111	7	9
Contour sawing and filing	912	302	58
Cutoff Machines	13,111	2,485	1,652
Bandsaw	3,576	615	342
Abrasive disk	1,626	226	72
Hacksaws	4,404	1,239	605
Rotary, hot or cold	1,835	255	430
Other	1,670	150	203
Drilling Machines	41,175	8,123	6,874
Sensitive	13,733	2,890	821
Upright: Single-spindle	12,839	2,179	3,172
Gang	3,090	741	599
Radial	6,029	1,351	1,320
Multi-spindle cluster, adjustable & fixed centers	1,218	215	250
Unit head and way type, multi-spindle	1,227	454	80
Deep-hole drills	1,273	126	365
Other	1,766	167	267
Gear Cutting and Finishing Machines	3,132	600	404
Hobbing machines	941	248	130
Shapers, gear	738	107	92
Cutters, form-milling type	172	102	85
Bevel gear cutters (not planer)	365	36	6
Cutters, planer type	74	6	30
Grinders, gear	480	46	16
Shavers, gear	137	23	4
Burnishing and lapping	94	5	3
Chamfering, tooth pointing, tooth rounding	44	–	–
Other	87	27	36
Gear Checking Machines	424	156	13
Grinding Machines	51,677	9,581	7,761
External cylindrical, plain and universal	4,208	1,006	603
Internal cylindrical	2,419	229	178
Centerless: External	624	59	51
Internal	21	6	2
Surface: Rotary table type	2,066	332	368
Reciprocating type	3,325	457	441
Disk, horizontal and vertical	2,006	429	388
Tool and cutter	9,024	1,841	1,598
Bench, floor stand, and snag	18,669	4,334	3,547
Abrasive belt (not polishing)	721	66	24
Other	8,594	822	561
Honing and Lapping	2,218	276	142
Honing	1,497	169	27
Lapping: External	299	44	68
Internal	236	24	41
Surface	186	39	6
Lathes	51,048	9,069	10,876
Bench and floor, light-duty	7,296	1,691	1,244
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	22,707	4,493	6,298
Turret lathes: Ram type and hand screw	6,011	1,124	1,089
Saddle type	3,444	751	488
Automatic chucking, horizontal and vertical	1,792	239	362
Automatic between centers chucking	1,146	86	40
Automatic screw machines, bar	4,067	478	381
Gun and shaft boring	984	44	377
Other	3,601	163	597
Milling Machines	31,623	5,228	6,433
Bench type	1,057	276	57
Hand	1,747	335	734
Knee-type, horizontal	7,874	1,761	1,393
Vertical	7,187	1,112	994
Automatic and manufacturing	4,026	493	384
Bed (Lincoln) type, incl automatic rise and fall	3,029	207	810
Planer type	583	115	190
Die sinkers (except engraving) & duplicators	2,513	508	524
Other	3,607	421	1,347
Planers	3,553	493	1,804
Double housing	2,007	221	1,180
Openside	974	173	353
Other	572	99	271
Pipe Cutting and Threading Machines	3,006	769	701
Polishing and Buffing Machines	10,769	2,172	640
Speed lathes	1,571	225	105
Polishing stands	7,911	1,800	435
Abrasive belt	893	110	13
Other	394	37	87
Rifle Boring Machines (not deep-hole drills)	882	60	77
Shapers	7,153	1,450	2,433
Horizontal	4,865	1,068	1,686
Vertical, including slotters	1,794	269	503
Keyseaters	492	113	244
Threading (except pipe)	4,734	787	559
Tapping	2,292	362	240
Hobbing and milling	1,170	190	59
Die type	393	129	112
Grinders, thread	506	26	6
Rolling machines, thread	105	8	27
Other	268	72	115
Other Machine Tools	1,223	251	383
METAL FORMING MACHINERY	49,701	8,766	13,284
Bending and Forming Machines	5,336	1,419	1,414
Bending rolls, sheet and plate	1,555	321	668
Bending rolls, bars and shapes	394	56	95
Power bending brakes	735	209	95
Rotary forming machines	376	113	61
Bending machines, pipe and bar	981	228	121
Other	1,295	492	374
Hydraulic Presses	7,770	765	1,630
Vertical, single action	5,102	527	906
Vertical, double and triple action	386	24	147
Horizontal	935	111	408
Other (including hydro-pneumatic)	1,347	103	169
Pneumatic Presses (except hydro-pneumatic)	502	195	36
Mechanical Presses, Power Driven	14,319	2,507	3,642
Inclinable	3,438	1,015	741
Vertical, C-frame	2,729	565	844
Vertical, straight-sided	5,491	569	1,517
Dieing machines	286	27	85
Horizontal	538	235	81
Other	1,837	96	374
Punching and Shearing Machines	7,033	1,599	2,542
Punching machines	2,366	445	1,047
Plate and sheet shears	2,364	567	661
Bar and angle shears	1,165	338	488
Rotary shears	407	135	111
Other	731	114	235
Forging Machinery (except presses)	7,512	1,371	3,696
Hammers, steam or air	2,771	229	1,322
Hammers, gravity drop	2,199	415	1,262
Hammers, helve	634	154	408
Forging machines (headers) and rolls	1,371	498	484
Other	537	75	220
Swaging Machines	546	77	69
Wire and Strip Forming Machines	345	95	54
Die Casting Machines	5,518	503	33
Hot chamber	2,156	259	27
Cold chamber	3,362	244	6
Plastic Molding Machines	68	32	–
Injection	15	4	–
Compression	53	28	–
Riveting Machines (Not Portable)	752	203	168
OTHER SHOP EQUIPMENT	164,957	35,505	23,713
Electric Welding Machines (Not Hand)	23,120	6,817	853
Arc: Motor-generator set	17,497	5,683	786
Transformer	3,026	369	13
Automatic and other	717	205	14
Resistance: Spot	988	401	30
Projection	65	20	–
Gun	415	36	–
Seam	205	33	–
Butt and flash	207	70	10
Gas Welding, Cutting Machines (Not Hand)	2,626	469	14
Flame cutting	2,260	385	14
Welding	366	84	–
Balancing Machines	681	184	146
Air Compressors	7,316	1,013	1,246
Plating Equipment	3,601	1,117	138
Machines	405	78	7
Tanks	3,057	960	131
Barrels	139	79	–
Materials Heating Equipment	20,689	4,315	4,211
Heat-treating furnaces	8,867	1,648	1,556
Stock-heating furnaces	6,436	1,574	1,759
Salt baths	883	109	43
Induction heating units	1,091	28	3
Baking and drying ovens	3,132	918	798
Flame hardening	280	38	52
Cleaning Equipment	12,774	2,324	1,034
Tumbling barrels	3,601	1,069	606
Shot and abrasive blast	4,874	314	210
Parts washing machines	2,207	578	21
Pickling machines	127	3	6
Tanks	1,965	360	191
Cranes, Overhead Traveling	13,361	1,828	7,262
Hoists (Incl. Jib and Rail Mounting)	62,807	13,401	8,289
Chain, hand	40,555	9,881	4,090
Electric	17,964	2,565	3,326
Pneumatic	4,288	955	873
Industrial Trucks	17,982	4,097	520
Lift	7,646	792	297
Truck-tractor	2,514	329	142
Powered hand trucks	5,847	2,414	6
Crane	1,975	592	75

Precision Mechanisms

925 plants, 226,047 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**113,136**	**35%**	**15%**
Metal Forming	**22,835**	**46**	**24**
Other Equip.	**30,808**	**27**	**7**
Total	**166,779**	**35**	**15**

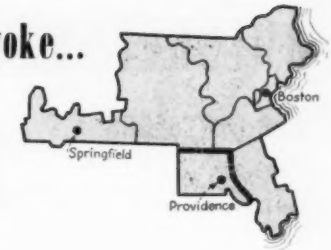
Laboratory, scientific, and engineering instruments; mechanical measuring and controlling instruments; optical instruments; surgical, medical, and dental instruments and equipment; photographic equipment; watches, clocks, clockwork devices, and parts. (Standard Industrial Classification 38)



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	113,136	22,955	16,600
Boring Machines	1,404	191	144
Horizontal boring, drilling, and milling	495	23	46
Vertical boring mills including vertical turret lathes	145	25	95
Precision, horizontal and vertical	309	42	–
Jig boring, horizontal and vertical	369	97	3
Other	86	4	–
Broaching Machines	577	110	137
Horizontal internal	114	20	20
Horizontal surface	34	–	–
Vertical internal	210	20	50
Vertical surface	144	67	17
Other	75	3	50
Contour sawing and filing	1,037	200	95
Cutoff Machines	4,240	919	468
Bandsaw	1,622	291	48
Abrasive disk	664	180	11
Hacksaws	1,548	357	350
Rotary, hot or cold	182	60	43
Other	224	31	16
Drilling Machines	24,855	4,740	3,086
Sensitive	5,007	620	566
Upright: Single spindle	12,163	2,154	1,239
Gang	5,178	1,340	1,031
Radial	661	195	124
Multi-spindle cluster, adjustable & fixed center	1,075	378	80
Unit head and way type, multi-spindle	224	1	–
Deep-hole drills	71	–	34
Other	476	52	12
Gear Cutting and Finishing Machines	3,966	772	255
Hobbing machines	1,585	434	49
Shapers, gear	242	35	4
Cutters, form-milling type	1,553	214	184
Bevel gear cutters (not planer)	93	25	6
Cutters, planer type	3	–	3
Grinders, gear	–	–	–
Shavers, gear	26	–	–
Burnishing and lapping	406	61	–
Chamfering, tooth pointing, tooth rounding	5	–	–
Other	53	3	9
Gear Checking Machines	209	11	–
Grinding Machines	18,152	3,832	1,457
External cylindrical, plain and universal	1,945	383	224
Internal cylindrical	318	124	28
Centerless: External	276	3	3
Internal	12	–	–
Surface: Rotary table type	445	49	48
Reciprocating type	2,324	542	198
Disk, horizontal and vertical	483	177	101
Tool and cutter	3,063	507	215
Bench, floor-stand, and snag	6,754	1,612	596
Abrasive belt (not polishing)	1,672	351	33
Other	680	84	11
Honing and Lapping	1,431	178	85
Honing	313	78	3
Lapping: External	312	38	16
Internal	196	3	23
Surface	610	59	43
Lathes	32,528	6,946	6,687
Bench and floor, light-duty	11,409	2,439	2,520
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	6,176	1,348	1,876
Turret lathes: Ram type and hand screw	5,706	1,184	850
Saddle type	631	184	8
Automatic chucking, horizontal and vertical	348	20	123
Automatic between centers chucking	40	14	3
Automatic screw machines, bar	7,190	1,316	1,242
Gun and shaft boring	–	–	–
Other	828	221	55
Milling Machines	12,421	2,520	2,590
Bench type	1,762	500	347
Hand	1,946	286	617
Knee-type, horizontal	1,513	1,201	1,098
Vertical	1,676	407	95
Automatic and manufacturing	1,098	67	94
Bed (Lincoln) type, incl automatic rise and fall	549	17	17
Planer type	126	53	62
Die sinkers (except engraving) & duplicators	330	50	–
Other	436	39	107
Planers	206	35	–
Double housing	94	20	75
Openside	41	4	27
Other	71	11	41
Pipe Cutting and Threading Machines	364	30	37
Polishing and Buffing Machines	6,220	1,217	657
Speed lathes	2,425	394	458
Polishing stands	2,158	609	122
Abrasive belt	1,138	193	71
Other	499	21	6
Rifle Rocking Machines (not deep-hole drilling)	–	–	–
Shapers	1,380	391	410
Horizontal	1,275	354	387
Vertical, including slotters	82	37	3
Keyseaters	23	–	20
Threading (except pipe)	2,596	552	323
Tapping	1,640	404	133
Hobbing and milling	129	23	34
Die type	22	3	–
Grinders, thread	93	3	–
Rolling machines, thread	155	37	14
Other	557	82	142
Other Machine Tools	1,550	211	169
METAL FORMING MACHINERY	22,835	4,986	5,583
Bending and Forming Machines	2,140	451	562
Bending rolls, sheet and plate	536	101	233
Bending rolls, bars and shapes	122	13	71
Power bending brakes	310	88	20
Rotary forming machines	99	1	3
Bending machines, pipe and bar	311	83	56
Other	762	165	179
Hydraulic Presses	1,032	86	51
Vertical, single action	963	79	51
Vertical, double and triple action	18	–	–
Horizontal	–	–	–
Other (including hydro-pneumatic)	51	7	–
Pneumatic Presses (except hydro-pneumatic)	530	7	–
Mechanical Presses, Power Driven	12,771	3,245	3,355
Inclinable	4,127	875	696
Vertical, C-frame	4,446	1,670	1,406
Vertical, straight-sided	1,570	381	563
Dieing machines	274	25	17
Horizontal	70	1	31
Other	2,284	293	642
Punching and Shearing Machines	2,574	406	625
Punching machines	1,176	92	594
Plate and sheet shears	861	226	129
Bar and angle shears	62	3	37
Rotary shears	186	28	48
Other	289	57	17
Forging Machinery (except presses)	280	67	119
Hammers, steam or air	34	–	17
Hammers, gravity drop	105	22	82
Hammers, helve	3	–	3
Forging machines (headers) and rolls	135	45	17
Other	3	–	–
Swaging Machines	1,015	306	453
Wire and Strip Forming Machines	194	–	100
Die Casting Machines	130	–	–
Hot chamber	87	–	–
Cold chamber	43	–	1
Plastic Molding Machines	475	67	–
Injection	317	17	–
Compression	158	50	–
Riveting Machines (Not Portable)	1,694	351	117
OTHER SHOP EQUIPMENT	30,808	6,214	2,023
Electric Welding Machines (Not Hand)	2,027	858	306
Arc: Motor-generator set	618	67	–
Transformer	493	290	–
Automatic and other	29	21	–
Resistance: Spot	1,741	428	289
Projection	50	34	–
Gun	17	–	–
Seam	17	–	–
Butt and flash	62	18	17
Gas Welding, Cutting Machines (Not Hand)	454	143	6
Flame cutting	171	21	–
Welding	283	122	6
Balancing Machines	247	23	20
Air Compressors	2,401	635	101
Blasting Equipment	6,320	723	147
Machines	193	18	37
Tanks	5,200	605	85
Barrels	227	100	25
Materials Heating Equipment	5,009	1,135	469
Heat-treating furnaces	2,388	621	297
Stock-heating furnaces	363	58	65
Salt baths	419	45	–
Induction heating units	187	3	–
Baking and drying ovens	1,391	372	63
Flame hardening	260	36	44
Cleaning Equipment	6,284	1,267	636
Tumbling barrels	2,007	698	604
Shot and abrasive blast	479	203	4
Parts washing machines	1,235	132	–
Pickling machines	118	10	17
Tanks	1,449	224	11
Cranes, Overhead Traveling	256	11	39
Hoists (Incl. Jib and Rail Mounting)	4,773	1,153	282
Chain, hand	2,831	1,148	248
Electric	1,900	5	34
Pneumatic	42	–	–
Industrial Trucks	2,237	266	17
Lift	1,900	245	17
Truck-tractor	245	20	–
Powered hand trucks	39	–	–
Crane	53	1	–

BOSTON...Worcester...Springfield—Holyoke...

and Providence-Fall River-New Bedford



These four marketing areas include Essex, Middlesex, Norfolk, Suffolk, Worcester, Hampden, and Bristol counties in Massachusetts; and Providence County in Rhode Island

1144 plants, 290,996 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	149,536	47%	27%
Metal Forming	27,894	60	35
Other Equip.	56,969	37	11
Total	234,399	45	24

	TOTAL	10-20 YEARS	OVER 20 YR
MACHINE TOOLS	149,536	29,581	39,259
Boring Machines	3,717	684	900
Horizontal boring, drilling, and milling	1,164	251	306
Vertical boring mills including vertical turret lathes	1,297	235	422
Precision, horizontal and vertical	602	66	35
Jig boring, horizontal and vertical	453	101	47
Other	201	31	90
Broaching Machines	1,069	194	107
Horizontal internal	426	95	91
Horizontal surface	46	21	–
Vertical internal	212	20	4
Vertical surface	316	32	–
Other	69	26	12
Contour sawing and filing	427	51	47
Cutoff Machines	5,014	1,012	795
Bandsaw	1,592	196	196
Abrasive disk	596	90	24
Hacksaws	1,908	534	347
Rotary, hot or cold	366	70	118
Other	492	122	110
Drilling Machines	25,563	4,848	6,124
Sensitive	5,735	760	1,270
Upright: Single-spindle	9,283	1,837	2,166
Gang	4,193	770	1,529
Radial	2,417	478	510
Multi-spindle cluster, adjustable & fixed center	1,492	514	295
Unit head and way type, multi-spindle	821	188	115
Deep-hole drills	462	66	35
Other	1,160	235	204
Gear Cutting and Finishing Machines	3,472	923	1,134
Hobbing machines	1,239	263	225
Shapers, gear	854	334	231
Cutters, form-milling type	681	169	446
Bevel gear cutters (not planer)	205	51	102
Cutters, planer type	94	15	62
Grinders, gear	98	15	8
Shavers, gear	76	4	4
Burnishing and lapping	66	12	8
Chamfering, tooth pointing, tooth rounding	49	16	11
Other	110	24	27
Gear Checking Machines	213	14	43
Grinding Machines	26,496	5,325	5,094
External cylindrical, plain and universal	3,690	774	896
Internal cylindrical	1,156	189	177
Centerless: External	533	157	47
Internal	20	3	2
Surface: Rotary table type	1,266	290	188
Reciprocating type	4,014	860	564
Disk, horizontal and vertical	1,051	204	353
Tool and cutter	4,147	886	958
Bench, floor stand, and snag	7,297	1,462	1,435
Abrasive belt (not polishing)	1,358	222	137
Other	1,764	278	337
Honing and Lapping	1,455	245	180
Honing	564	96	8
Lapping: External	380	79	74
Internal	291	36	36
Surface	220	34	50
Lathes	35,367	6,902	11,714
Bench and floor, light-duty	7,976	1,399	2,340
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	12,434	2,262	5,310
Turret lathes: Ram type and hand screw	5,024	900	1,413
Saddle type	1,564	285	235
Automatic chucking, horizontal and vertical	1,103	327	296
Automatic between-centers chucking	114	51	39
Automatic screw machines, bar	5,780	1,486	1,378
Gun and shaft boring	151	–	31
Other	1,221	192	672
Milling Machines	20,040	3,635	6,134
Bench type	951	192	403
Hand	2,676	649	1,033
Knee-type, horizontal	5,858	1,125	1,958
Vertical	2,454	431	421
Automatic and manufacturing	4,267	841	345
Bed (Lincoln) type, incl automatic rise and fall	263	54	71
Planer type	319	66	118
Die sinkers (except engraving) & duplicators	426	63	111
Other	2,826	214	1,674
Planers	1,502	278	845
Double housing	937	145	668
Openside	408	98	118
Other	157	35	59
Pipe Cutting and Threading Machines	612	180	98
Polishing and Buffing Machines	7,175	1,267	1,765
Speed lathes	2,536	547	686
Polishing stands	3,036	461	953
Abrasive belt	1,109	153	71
Other	492	106	55
Rifle Boring Machines (not deep-hole drills)	283	29	14
Shapers	2,586	774	695
Horizontal	1,780	551	637
Vertical, including slotters	551	141	149
Keyseaters	255	82	110

	TOTAL	10-20 YEARS	OVER 20 YR
Threading (except pipe)	3,984	505	1,096
Tapping	1,450	122	270
Hobbing and milling	807	174	189
Die type	293	43	106
Grinders, thread	488	71	35
Rolling machines, thread	370	71	194
Other	576	24	392
Other Machine Tools	10,561	2,635	2,273
METAL FORMING MACHINERY	27,894	6,903	9,876
Bending and Forming Machines	2,278	490	791
Bending rolls, sheet and plate	542	145	204
Bending rolls, bars and shapes	176	55	106
Power bending brakes	566	106	74
Rotary forming machines	136	20	27
Bending machines, pipe and bar	263	74	55
Other	596	90	325
Hydraulic Presses	2,223	332	506
Vertical, single action	1,415	144	310
Vertical, double and triple action	361	106	71
Horizontal	94	27	39
Other (including hydro-pneumatic)	353	55	86
Pneumatic Presses (except hydro-pneumatic)	201	9	12
Mechanical Presses, Power Driven	14,015	4,054	5,591
Inclinable	6,167	2,231	1,445
Vertical, C-frame	2,601	533	1,760
Vertical, straight-sided	2,558	670	1,339
Dieing machines	157	51	16
Horizontal	90	16	35
Other	2,442	553	996
Punching and Shearing Machines	3,232	807	834
Punching machines	968	290	298
Plate and sheet shears	1,588	351	270
Bar and angle shears	153	39	55
Rotary shears	339	88	125
Other	184	39	86
Forging Machinery (except presses)	2,063	371	1,071
Hammers, steam or air	429	37	125
Hammers, gravity drop	849	156	455
Hammers, helve	219	12	191
Forging machines (headers) and rolls	448	140	245
Other	118	24	55
Swaging Machines	868	165	474
Wire and Strip Forming Machines	333	214	241
Die Casting Machines	394	20	11
Hot chamber	159	8	–
Cold chamber	235	12	11
Plastic Molding Machines	1,029	159	–
Injection	194	–	–
Compression	835	159	–
Riveting Machines (Not Portable)	1,258	282	347
OTHER SHOP EQUIPMENT	56,969	13,455	7,325
Electric Welding Machines (Not Hand)	10,873	3,073	495
Arc: Motor-generator set	2,575	459	169
Transformer	943	336	16
Automatic and other	188	55	16
Resistance: Spot	6,700	2,117	251
Projection	71	12	–
Gun	35	4	–
Seam	141	35	–
Butt and flash	220	55	43
Gas Welding, Cutting Machines (Not Hand)	793	118	31
Flame cutting	512	102	15
Welding	281	16	16
Balancing Machines	380	86	63
Air Compressors	2,378	531	288
Plating Equipment	3,430	825	159
Machines	292	55	12
Tanks	2,462	468	147
Barrels	676	302	–
Materials Heating Equipment	9,155	1,920	1,124
Heat-treating furnaces	3,989	1,029	443
Stock-heating furnaces	2,089	282	412
Salt baths	496	118	35
Induction heating units	782	12	4
Baking and drying ovens	1,607	455	180
Flame hardening	192	24	60
Cleaning Equipment	7,580	1,792	1,283
Tumbling barrels	3,470	992	986
Shot and abrasive blast	1,174	282	102
Parts washing machines	929	151	27
Pickling machines	27	–	7
Tanks	1,980	365	161
Cranes, Overhead Traveling	2,422	447	1,737
Hoists (Incl. Jib and Rail Mounting)	14,638	3,950	1,888
Chain, hand	8,284	2,887	1,028
Electric	5,584	902	699
Pneumatic	770	161	161
Industrial Trucks	4,320	713	247
Lift	3,303	681	208
Truck-tractor	376	24	12
Powered hand trucks	492	4	27
Crane	149	24	–

BRIDGEPORT—New Haven—Waterbury:... and Hartford

These two marketing areas include Fairfield, New Haven, and Hartford counties in Connecticut

651 plants, 211,354 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**107,983**	**48%**	**33%**
Metal Forming	**23,445**	**67**	**44**
Other Equip.	**36,576**	**40**	**17**
Total	**168,004**	**49**	**31**

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	107,983	16,710	35,538
Boring Machines	2,214	306	315
Horizontal boring, drilling, and milling	417	67	132
Vertical boring mills including vertical turret lathes	593	84	101
Precision, horizontal and vertical	777	87	51
Jig boring, horizontal and vertical	351	62	25
Other	76	6	6
Broaching Machines	464	89	132
Horizontal internal	165	33	51
Horizontal surface	20	9	3
Vertical internal	113	8	39
Vertical surface	138	31	25
Other	28	8	14
Countersinking and filing	396	48	28
Cutoff Machines	2,280	427	369
Bandsaw	822	115	84
Abrasive disk	298	51	23
Hacksaws	795	216	169
Rotary, hot or cold	110	20	45
Other	255	25	48
Drilling Machines	19,348	3,024	4,298
Sensitive	3,942	393	410
Upright: Single-spindle	8,280	1,399	1,813
Gang	3,475	690	1,060
Radial	966	219	152
Multi-spindle cluster, adjustable & fixed center	1,320	141	126
Unit head and way type, multi-spindle	252	73	39
Deep-hole drills	371	11	279
Other	742	98	419
Gear Cutting and Finishing Machines	1,602	250	205
Hobbing machines	475	104	126
Shapers, gear	461	62	28
Cutters, form-milling type	73	25	25
Bevel gear cutters (not planer)	98	17	3
Cutters, planer type	21	8	11
Graders, gear	316	8	3
Shavers, gear	42	6	6
Burnishing and lapping	45	17	–
Chamfering, tooth pointing, tooth rounding	34	3	3
Other	37	–	–
Gear Checking Machines	279	18	8
Grinding Machines	21,180	4,226	4,059
External cylindrical, plain and universal	2,878	434	496
Internal cylindrical	1,586	248	218
Centerless: External	755	162	87
Internal	76	14	2
Surface: Rotary table type	969	157	138
Reciprocating type	2,582	542	289
Disk, horizontal and vertical	441	98	143
Tool and cutter	1,532	837	692
Bench, floorstand, and snag	3,706	582	1,109
Abrasive belt (not polishing)	415	48	–
Other	4,280	1,104	888
Honing and Lapping	1,489	384	127
Honing	248	42	–
Lapping: External	101	6	3
Internal	112	20	11
Surface	928	316	113
Lathes	22,650	3,621	8,772
Bench and floor, light-duty	3,405	388	1,175
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	6,123	1,183	2,245
Turret lathes: Ram type and hand screw	2,776	419	1,071
Saddle type	560	146	115
Automatic chucking, horizontal and vertical	1,015	220	239
Automatic between centers chucking	320	11	6
Automatic screw machines, bar	6,664	1,139	2,505
Gun and shaft boring	102	3	77
Other	1,685	112	1,339
Milling Machines	16,029	1,858	7,479
Bench type	340	118	84
Hand	3,306	403	1,953
Knee-type, horizontal	3,357	596	1,672
Vertical	1,871	233	287
Automatic and manufacturing	3,035	281	577
Bed (Lincoln) type, incl automatic rise and fall	1,163	20	1,122
Planer type	268	61	129
Die sinkers (except engraving) & duplicators	382	39	135
Other	2,307	107	1,520
Planers	703	118	492
Double housing	554	93	407
Openside	84	14	37
Other	65	11	48
Pipe Cutting and Threading Machines	242	31	70
Polishing and Buffing Machines	8,467	1,168	2,421
Speed lathes	2,246	230	528
Polishing stands	4,070	662	1,458
Abrasive belt	724	56	98
Other	1,427	220	337
Rifle Working Machines (not deep-hole drills)	82	7	37
Shapers	2,275	536	1,265
Horizontal	1,892	479	1,071
Vertical, including slotters	273	37	141
Keyseaters	110	20	53
Threading (except pipe)	7,732	389	5,284
Tapping	2,163	261	1,035
Hobbing and milling	459	110	101
Die type	221	59	76
Grinders, thread	195	20	–
Rolling machines, thread	581	39	346
Other	4,113	20	3,726
Other Machine Tools	551	90	177
METAL FORMING MACHINERY	23,445	5,281	10,273
Bending and Forming Machines	1,044	163	264
Bending rolls, sheet and plate	306	62	81
Bending rolls, bars and shapes	37	6	6
Power bending brakes	180	25	28
Rotary forming machines	116	28	6
Bending machines, pipe and bar	214	14	51
Other	191	28	34
Hydraulic Presses	924	95	65
Vertical, single action	674	73	31
Vertical, double and triple action	73	8	8
Horizontal	79	3	20
Other (including hydro-pneumatic)	98	11	6
Pneumatic Presses (except hydro-pneumatic)	303	22	–
Mechanical Presses, Power Driven	13,889	3,530	6,908
Inclinable	4,822	1,349	1,667
Vertical, C-frame	3,725	1,023	1,920
Vertical, straight-sided	3,611	829	2,376
Dieing machines	247	37	121
Horizontal	65	17	37
Other	1,419	275	787
Punching and Shearing Machines	1,228	177	485
Punching machines	464	37	253
Plate and sheet shears	451	81	143
Bar and angle shears	98	20	56
Rotary shears	91	14	8
Other	124	25	25
Forging Machinery (except presses)	2,142	464	1,462
Hammers, steam or air	171	22	79
Hammers, gravity drop	655	152	515
Hammers, helve	114	8	83
Forging machines (headers) and rolls	1,061	237	748
Other	141	45	37
Swaging Machines	65	6	28
Wire and Strip Forming Machines	1,058	249	532
Die Casting Machines	524	59	12
Hot chamber	134	17	3
Cold chamber	390	42	9
Plastic Molding Machines	762	207	42
Injection	212	44	–
Compression	550	163	42
Riveting Machines (Not Portable)	1,506	309	533
OTHER SHOP EQUIPMENT	36,576	8,490	5,991
Electric Welding Machines (Not Hand)	2,659	634	189
Arc: Motor-generator set	801	160	101
Transformer	143	8	6
Automatic and other	112	11	17
Resistance: Spot	1,036	311	37
Projection	275	48	3
Gun	53	6	–
Seam	90	45	–
Butt and flash	149	45	25
Gas Welding, Cutting Machines (Not Hand)	284	45	3
Flame cutting	160	31	3
Welding	124	14	–
Balancing Machines	270	25	17
Air Compressors	1,343	227	243
Plating Equipment	4,871	1,400	275
Machines	330	31	56
Tanks	3,391	840	188
Barrels	1,150	529	31
Materials Heating Equipment	4,653	1,023	1,046
Heat-treating furnaces	2,436	509	579
Stock-heating furnaces	672	219	256
Salt baths	479	115	48
Induction heating units	253	3	–
Baking and drying ovens	717	166	146
Flame hardening	96	11	17
Cleaning Equipment	8,258	2,297	2,217
Tumbling barrels	5,091	1,564	2,035
Shot and abrasive blast	647	81	70
Parts washing machines	787	67	8
Pickling machines	81	31	8
Tanks	1,652	554	96
Cranes, Overhead Traveling	1,501	129	393
Hoists (Incl. Jib and Rail Mounting)	10,397	2,340	1,472
Chain, hand	6,285	1,897	1,042
Electric	3,621	385	388
Pneumatic	491	58	42
Industrial Trucks	2,340	370	136
Lift	1,661	322	93
Truck-tractor	211	45	34
Powered hand trucks	401	–	3
Crane	67	3	6

NEW ENGLAND

This area includes all of Maine, New Hampshire, and Vermont, and those areas in Massachusetts, Rhode Island, and Connecticut not covered in the two previous tables

402 plants, 120,361 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**61,986**	**56%**	**39%**
Metal Forming	**10,819**	**56**	**34**
Other Equip.	**25,512**	**42**	**17**
Total	**98,317**	**52**	**32**

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	61,986	10,744	23,716
Boring Machines	1,382	369	472
Horizontal boring, drilling, and milling	430	170	151
Vertical boring mills including vertical turret lathes	515	87	258
Precision, horizontal and vertical	102	10	5
Jig boring, horizontal and vertical	262	68	34
Other	73	34	24
Broaching Machines	224	29	103
Horizontal internal	171	29	93
Horizontal surface	–	–	–
Vertical internal	29	–	5
Vertical surface	19	–	–
Other	5	–	5
Contour sawing and filing	316	24	53
Cutoff Machines	1,834	370	428
Band-saw	501	97	78
Abrasive disk	262	39	24
Hacksaws	855	190	190
Rotary, hot or cold	167	39	117
Other	49	5	19
Drilling Machines	10,075	1,841	3,734
Sensitive	3,106	454	1,302
Upright: Single-spindle	3,456	735	1,218
Gang	1,940	258	717
Radial	1,049	326	292
Multi-spindle cluster, adjustable & fixed center	233	53	78
Unit head and way type, multi-spindle	112	–	34
Deep-hole drills	19	–	15
Other	160	15	78
Gear Cutting and Finishing Machines	2,203	664	943
Hobbing machines	510	68	207
Shapers, gear	630	248	204
Cutters, form-milling type	690	244	428
Bevel gear cutters (not planer)	101	10	53
Cutters, planer type	15	–	10
Grinders, gear	19	5	5
Shavers, gear	58	15	–
Burnishing and lapping	53	20	13
Chamfering, tooth pointing, tooth rounding	44	19	13
Other	83	35	10
Gear Checking Machines	289	57	77
Grinding Machines	14,837	2,635	4,008
External cylindrical, plain and universal	1,797	408	459
Internal cylindrical	580	107	155
Centerless: External	238	53	10
Internal	10	–	–
Surface: Rotary table type	525	78	151
Reciprocating type	1,536	292	248
Disk, horizontal and vertical	199	49	49
Tool and cutter	2,095	515	355
Bench, floor-stand, and snag	5,987	914	2,319
Abrasive belt (not polishing)	626	83	34
Other	1,244	136	228
Honing and Lapping	264	78	25
Honing	156	24	10
Lapping: External	62	–	–
Internal	92	34	–
Surface	53	20	15
Lathes	14,020	1,852	6,443
Bench and floor, light-duty	2,638	292	640
Engine, heavy-duty, incl toolrm, mfg, nut form, gap	5,545	651	3,780
Turret lathes: Ram type and hand screw	2,464	365	1,055
Saddle type	1,200	209	452
Automatic chucking, horizontal and vertical	503	83	202
Automatic between centers chucking	405	116	52
Automatic screw machines, bar	1,182	117	199
Gun and shaft boring	–	–	–
Other	83	19	63
Milling Machines	7,556	1,293	3,199
Bench type	224	44	87
Hand	1,085	117	568
Knee-type, horizontal	2,876	661	1,322
Vertical	1,249	282	365
Automatic and manufacturing	1,054	97	533
Bed (Lincoln) type, incl automatic rise and fall	292	–	68
Planer type	228	34	131
Die sinkers (except engraving) & duplicators	190	–	5
Other	358	58	120
Planers	778	116	534
Double housing	457	53	330
Openside	175	39	97
Other	146	24	107
Pipe Cutting and Threading Machines	467	112	92
Polishing and Buffing Machines	3,419	517	1,320
Speed lathes	1,072	180	481
Polishing stands	1,340	299	465
Abrasive belt	421	19	73
Other	586	19	301
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	1,359	316	698
Horizontal	1,091	253	542
Vertical, including slotters	83	19	44
Keyseaters	185	44	112
Threading (except pipe)	1,410	277	430
Tapping	455	136	49
Hobbing and milling	174	44	97
Die type	102	29	39
Grinders, thread	167	10	–
Rolling machines, thread	168	24	15
Other	344	34	230
Other Machine Tools	1,453	194	1,157
METAL FORMING MACHINERY	10,819	2,430	3,641
Bending and Forming Machines	948	209	466
Bending rolls, sheet and plate	233	68	117
Bending rolls, bars and shapes	122	–	87
Power bending brakes	136	58	24
Rotary forming machines	102	24	29
Bending machines, pipe and bar	97	15	29
Other	258	44	180
Hydraulic Presses	743	64	58
Vertical, single action	651	49	34
Vertical, double and triple action	24	5	–
Horizontal	49	10	24
Other (including hydro-pneumatic)	19	–	–
Pneumatic Presses (except hydro-pneumatic)	10	–	–
Mechanical Presses, Power Driven	5,850	1,368	1,780
Inclinable	3,770	1,210	870
Vertical, C-frame	733	126	246
Vertical, straight-sided	798	173	503
Dieing machines	185	–	5
Horizontal	24	15	–
Other	340	44	156
Punching and Shearing Machines	1,059	281	471
Punching machines	196	58	73
Plate and sheet shears	520	131	209
Bar and angle shears	92	29	53
Rotary shears	83	19	49
Other	170	44	87
Forging Machinery (except presses)	567	54	395
Hammers, steam or air	53	5	34
Hammers, gravity drop	187	10	123
Hammers, helve	122	5	97
Forging machines (headers) and rolls	93	15	49
Other	112	19	92
Swaging Machines	219	63	126
Wire and Strip Forming Machines	460	34	209
Die Casting Machines	139	–	–
Hot chamber	29	–	–
Cold chamber	110	–	–
Plastic Molding Machines	377	35	–
Injection	207	20	–
Compression	170	15	–
Riveting Machines (Not Portable)	447	122	136
OTHER SHOP EQUIPMENT	25,512	6,431	4,406
Electric Welding Machines (Not Hand)	2,331	609	190
Arc: Motor-generator set	734	165	49
Transformer	437	101	5
Automatic and other	73	24	19
Resistance: Spot	932	217	73
Projection	122	34	–
Gun	24	10	–
Seam	78	24	10
Butt and flash	131	34	34
Gas Welding, Cutting Machines (Not Hand)	335	151	10
Flame cutting	238	107	10
Welding	97	44	–
Balancing Machines	170	29	39
Air Compressors	1,696	620	214
Plating Equipment	1,154	134	106
Machines	34	5	–
Tanks	889	119	106
Barrels	231	10	–
Materials Heating Equipment	3,466	676	482
Heat-treating furnaces	1,853	360	306
Stock-heating furnaces	253	83	49
Salt baths	335	73	15
Induction heating units	209	–	–
Baking and drying ovens	758	141	107
Flame hardening	58	19	5
Cleaning Equipment	3,141	898	407
Tumbling barrels	2,134	805	348
Shot and abrasive blast	182	44	39
Parts washing machines	209	15	5
Pickling machines	15	–	–
Tanks	401	34	15
Cranes, Overhead Traveling	1,915	430	988
Hoists (Incl. Jib and Rail Mounting)	8,358	2,359	1,516
Chain, hand	4,946	1,853	906
Electric	3,197	496	497
Pneumatic	215	10	113
Industrial Trucks	2,746	525	354
Lift	1,976	392	241
Truck-tractor	297	41	82
Powered hand trucks	396	82	–
Crane	77	10	31

NEW YORK—Newark–Jersey City

2022 plants, 390,573 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**140,785**	**39%**	**15%**
Metal Forming	**39,544**	**48**	**19**
Other Equip.	**64,388**	**34**	**6**
Total	**244,717**	**39**	**13**

This marketing area includes Bronx, Kings, Queens, New York, Richmond, and Westchester counties in New York; and Bergen, Essex, Hudson, Middlesex, Passaic, and Union counties in New Jersey

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	140,785	33,881	20,627
Boring Machines	3,905	949	715
Horizontal boring, drilling, and milling	1,005	245	237
Vertical boring mills including vertical turret lathes	1,437	380	350
Precision, horizontal and vertical	521	79	25
Jig boring, horizontal and vertical	675	148	59
Other	267	97	44
Broaching Machines	583	145	127
Horizontal internal	205	46	79
Horizontal surface	25	–	3
Vertical internal	116	15	40
Vertical surface	232	84	5
Other	5	–	–
Contour sawing and filing	582	39	20
Cutoff Machines	6,603	1,569	870
Bandsaw	2,151	311	104
Abrasive disk	878	192	5
Hacksaws	2,362	933	302
Rotary, hot or cold	546	54	247
Other	666	79	212
Drilling Machines	31,233	6,909	3,628
Sensitive	7,386	1,273	720
Upright: Single-spindle	13,171	3,078	1,318
Gang	4,886	1,501	554
Radial	2,969	589	518
Multi-spindle cluster, adjustable & fixed center	1,357	202	326
Unit head and way type, multi-spindle	393	74	98
Deep-hole drills	68	25	–
Other	1,003	167	84 †
Gear Cutting and Finishing Machines	3,524	695	525
Hobbing machines	861	335	177
Shapers, gear	635	64	94
Cutters, form-milling type	997	109	154
Bevel gear cutters (not planer)	107	20	17
Cutters, planer type	35	–	20
Grinders, gear	305	49	19
Shavers, gear	98	–	–
Burnishing and lapping	407	103	5
Chamfering, tooth pointing, tooth rounding	20	5	–
Other	59	10	39
Gear Checking Machines	249	24	10
Grinding Machines	26,828	7,126	2,761
External cylindrical, plain and universal	2,675	635	375
Internal cylindrical	1,785	546	148
Centerless: External	2,056	706	113
Internal	243	82	10
Surface: Rotary table type	1,578	240	202
Reciprocating type	3,367	784	255
Disk, horizontal and vertical	1,114	449	148
Tool and cutter	5,428	877	720
Bench, floor-stand, and snagging	5,185	1,297	716
Abrasive belt (not polishing)	1,549	297	93
Other	1,830	1,113	44
Honing and Lapping	2,180	279	25
Honing	775	69	–
Lapping: External	524	111	5
Internal	259	64	13
Surface	622	35	13
Lathes	33,546	9,133	6,002
Bench and floor, light-duty	8,653	2,217	984
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	9,807	2,973	2,618
Turret lathes: Ram type and hand screw	5,087	1,235	1,166
Saddle type	1,947	630	138
Automatic chucking, horizontal and vertical	1,480	250	217
Automatic between centers chucking	113	5	34
Automatic screw machines, bar	3,944	1,600	687
Gun and shaft boring	–	–	–
Other	479	123	138
Milling Machines	13,162	3,303	2,556
Bench type	815	214	75
Hand	1,695	416	332
Knee-type, horizontal	4,423	1,361	937
Vertical	2,338	597	601
Automatic and manufacturing	850	222	207
Bed (Linetal) type, incl automatic rise and fall	335	10	29
Planer type	360	162	227
Die sinkers (except engraving) & duplicators	712	173	114
Other	634	108	83
Planers	1,905	232	597
Double housing	641	156	404
Openside	158	49	59
Other	206	25	114
Pipe Cutting and Threading Machines	601	163	79
Polishing and Buffing Machines	9,020	1,726	723
Speed lathes	2,244	568	307
Polishing stands	4,756	866	222
Abrasive belt	1,473	153	84
Other	567	39	10
Rifle Reaming Machines (not deep-hole drills)			
Shapers	2,909	895	1,127
Horizontal	2,277	747	915
Vertical, including slotters	376	54	148
Keyseaters	256	94	64

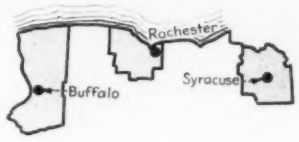
	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	3,651	517	783
Tapping	1,952	306	89
Hobbing and milling	225	64	59
Die type	239	49	–
Grinders, thread	168	5	5
Rolling machines, thread	363	54	120
Other	704	39	510
Other Machine Tools	1,104	177	79
METAL FORMING MACHINERY	39,544	11,457	7,556
Bending and Forming Machines	3,089	839	602
Bending rolls, sheet and plate	670	261	248
Bending rolls, bars and shapes	237	64	59
Power bending brakes	1,117	248	138
Rotary forming machines	292	49	59
Bending machines, pipe and bar	282	59	39
Other	491	158	59
Hydraulic Presses	1,844	227	257
Vertical, single action	1,425	113	202
Vertical, double and triple action	59	10	–
Horizontal	222	84	25
Other (including hydro-pneumatic)	138	20	20
Pneumatic Presses (except hydro-pneumatic)	415	29	41
Mechanical Presses, Power Driven	18,656	6,300	4,048
Inclinable	12,100	3,993	2,366
Vertical, C-frame	2,749	1,048	862
Vertical, straight-sided	2,344	787	749
Dieing machines	118	39	10
Horizontal	123	39	64
Other	1,222	394	197
Punching and Shearing Machines	4,273	1,112	1,036
Punching machines	1,814	415	577
Plate and sheet shears	1,314	286	182
Bar and angle shears	271	108	74
Rotary shears	440	138	99
Other	434	165	104
Forging Machinery (except presses)	628	197	159
Hammers, steam or air	178	20	54
Hammers, gravity drop	184	78	65
Hammers, helve	5	–	5
Forging machines (headers) and rolls	119	5	25
Other	142	94	10
Swaging Machines	322	133	35
Wire and Strip Forming Machines	3,483	1,157	768
Die Casting Machines	2,657	232	–
Hot chamber	1,289	100	–
Cold chamber	1,368	132	–
Plastic Molding Machines	1,647	458	115
Injection	484	42	–
Compression	1,163	416	115
Riveting Machines (Not Portable)	2,530	773	495
OTHER SHOP EQUIPMENT	64,388	18,171	4,078
Electric Welding Machines (Not Hand)	8,475	2,050	263
Arc: Motor-generator set	3,609	968	64
Transformer	1,514	550	51
Automatic and other	258	97	5
Resistance: Spot	3,093	836	159
Projection	42	11	–
Gun	116	16	–
Seam	26	–	–
Butt and flash	121	32	5
Gas Welding, Cutting Machines (Not Hand)	980	173	16
Flame cutting	637	110	16
Welding	343	63	–
Balancing Machines	255	74	49
Air Compressors	3,259	815	316
Plating Equipment	5,487	1,389	126
Machines	247	21	–
Tanks	3,509	952	16
Barrels	1,731	416	110
Materials Heating Equipment	7,225	1,897	548
Heat-treating furnaces	4,329	1,189	279
Stock-heating furnaces	389	158	58
Salt baths	353	74	26
Induction heating units	389	73	18
Baking and drying ovens	1,429	437	58
Flame hardening	358	26	11
Cleaning Equipment	9,902	3,333	401
Tumbling barrels	6,188	2,599	337
Shot and abrasive blast	607	79	16
Parts washing machines	1,167	224	32
Pickling machines	53	21	–
Tanks	1,897	610	16
Cranes, Overhead Traveling	3,758	1,352	552
Hoists (Incl. Jib and Rail-Mounting)	20,183	6,008	1,448
Chain, hand	10,418	3,888	773
Electric	8,672	1,788	537
Pneumatic	1,093	332	138
Industrial Trucks	4,865	1,080	359
Lift	3,556	808	347
Truck-tractor	536	62	5
Powered hand trucks	549	167	8
Crane	214	42	–

BUFFALO...Rochester...and Syracuse

453 plants, 185,209 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**48,787**	**43%**	**19%**
Metal Forming	**14,744**	**55**	**22**
Other Equip.	**17,519**	**35**	**9**
Total	**81,050**	**44**	**18**

These three marketing areas include Erie, Niagara, Monroe, and Onondaga counties, all in New York

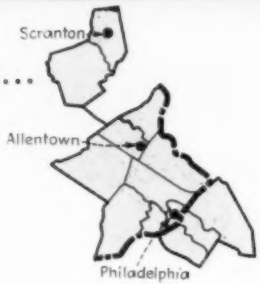


	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	48,787	11,534	9,516
Boring Machines	1,810	342	349
Horizontal boring, drilling, and milling	411	90	72
Vertical boring mills including vertical turret lathes	648	120	214
Precision, horizontal and vertical	364	57	45
Jig boring, horizontal and vertical	240	48	17
Other	147	27	–
Broaching Machines	367	95	40
Horizontal internal	130	36	30
Horizontal surface	23	3	–
Vertical internal	20	–	–
Vertical surface	144	44	10
Other	50	12	–
Contour sawing and filing	200	50	10
Cutoff Machines	1,801	453	184
Bandsaw	471	53	20
Abrasive disk	247	73	10
Hacksaw	685	220	37
Rotary, hot or cold	254	90	97
Other	144	17	20
Drilling Machines	10,861	2,552	1,817
Sensitive	1,784	354	414
Upright: Single spindle	3,631	698	451
Gang	2,788	658	487
Radial	945	251	251
Multi-spindle cluster, adjustable & fixed center	544	184	57
Unit head and way type, multi-spindle	324	50	107
Deep-hole drills	10	–	–
Other	835	147	40
Gear Cutting and Finishing Machines	1,013	250	219
Hobbing machines	307	60	67
Shapers, gear	130	40	40
Cutters, form-milling type	87	20	67
Bevel gear cutters (not planer)	311	107	12
Cutters, planer type	7	–	3
Grinders, gear	10	–	–
Shavers, gear	17	–	–
Burnishing and lapping	60	13	10
Chamfering, tooth pointing, tooth rounding	17	7	–
Other	67	3	20
Gear Checking Machines	214	25	32
Grinding Machines	8,560	2,251	971
External cylindrical, plain and universal	1,123	357	137
Internal cylindrical	374	114	43
Centerless: External	374	77	23
Internal	15	3	3
Surface: Rotary table type	331	57	47
Reciprocating type	1,273	394	87
Disk, horizontal and vertical	261	57	47
Tool and cutter	2,275	671	267
Bench, floorstand, and snag	1,677	384	237
Abrasive belt (not polishing)	219	43	3
Other	538	94	77
Honing and Lapping	373	51	13
Honing	184	20	–
Lapping: External	47	3	–
Internal	75	13	–
Surface	67	15	13
Lathes	12,479	2,806	3,336
Bench and floor, light-duty	2,713	521	868
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	3,303	875	808
Turret lathes: Ram type and hand screw	1,520	284	377
Saddle type	839	281	144
Automatic chucking, horizontal and vertical	641	194	137
Automatic between centers chucking	10	–	3
Automatic screw machines, bar	2,521	501	686
Gun and shaft boring	7	–	7
Other	915	150	304
Milling Machines	4,757	998	1,218
Bench type	254	70	67
Hand	938	170	310
Knee-type, horizontal	1,346	377	407
Vertical	642	140	120
Automatic and manufacturing	729	117	217
Bed (Lincoln) type, incl automatic rise and fall	140	20	7
Planer type	130	7	23
Die sinkers (except engraving) & duplicators	57	17	7
Other	321	80	60
Planers	351	76	216
Double housing	207	23	150
Openside	107	50	33
Other	37	3	33
Pipe Cutting and Threading Machines	204	73	33
Polishing and Buffing Machines	2,672	778	220
Speed lathes	1,042	297	84
Polishing stands	1,249	414	100
Abrasive belt	264	47	13
Other	117	20	23
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	1,136	327	314
Horizontal	808	237	164
Vertical, including slotters	204	67	53
Keyseaters	124	23	77

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	1,665	357	484
Tapping	792	194	94
Hobbing and milling	94	13	43
Die type	94	33	20
Grinders, thread	67	7	–
Rolling machines, thread	57	20	7
Other	561	94	320
Other Machine Tools	324	50	60
METAL FORMING MACHINERY	14,744	4,803	3,269
Bending and Forming Machines	1,483	460	323
Bending rolls, sheet and plate	341	120	37
Bending rolls, bars and shapes	124	33	33
Power bending brakes	240	87	37
Rotary forming machines	33	20	10
Bending machines, pipe and bar	37	10	7
Other	708	190	199
Hydraulic Presses	555	143	56
Vertical, single action	438	110	33
Vertical, double and triple action	20	10	–
Horizontal	50	10	20
Other (including hydro-pneumatic)	47	13	3
Pneumatic Presses (except hydro-pneumatic)	94	7	7
Mechanical Presses, Power Driven	7,942	3,045	2,385
Inclinable	3,036	1,646	615
Vertical, C-frame	2,588	681	865
Vertical, straight-sided	1,386	468	534
Dieing machines	20	10	–
Horizontal	104	33	10
Other	808	207	361
Punching and Shearing Machines	1,573	561	244
Punching machines	663	401	73
Plate and sheet shears	448	110	127
Bar and angle shears	50	17	7
Rotary shears	63	3	27
Other	147	30	10
Forging Machinery (except presses)	174	36	47
Hammers, steam or air	37	23	10
Hammers, gravity drop	73	–	20
Hammers, helve	7	–	7
Forging machines (headers) and rolls	27	13	3
Other	30	–	7
Swaging Machines	327	187	37
Size and Strip Forming Machines	43	23	–
Die Casting Machines	204	80	13
Hot chamber	167	60	13
Cold chamber	37	20	–
Plastic Molding Machines	114	17	–
Injection	10	–	–
Compression	104	17	–
Riveting Machines (Not Portable)	2,235	244	157
OTHER SHOP EQUIPMENT	17,519	4,540	1,552
Electric Welding Machines (Not Hand)	3,625	987	347
Arc: Motor-generator set	1,062	217	17
Transformer	564	140	–
Automatic and other	358	107	–
Resistance: Spot	991	351	147
Projection	190	43	3
Gun	20	–	20
Seam	73	–	10
Butt and flash	367	129	150
Gas Welding, Cutting Machines (Not Hand)	197	36	3
Flame cutting	160	33	3
Welding	37	3	–
Balancing Machines	281	70	10
Air Compressors	644	97	40
Plating Equipment	1,119	340	74
Machines	94	10	7
Tanks	731	267	47
Barrels	294	63	20
Materials Heating Equipment	2,256	516	151
Heat-treating furnaces	1,473	411	84
Stock-heating furnaces	174	37	20
Salt baths	104	7	7
Induction heating units	67	7	–
Baking and drying ovens	291	37	13
Flame hardening	147	17	27
Cleaning Equipment	2,381	563	347
Tumbling barrels	965	200	310
Shot and abrasive blast	154	37	10
Parts washing machines	571	234	13
Pickling machines	137	42	7
Tanks	554	50	7
Cranes, Overhead Traveling	1,359	468	310
Hoists (Incl. Jib and Rail Mounting)	4,216	1,082	256
Chain, hand	1,806	649	241
Electric	2,253	394	15
Pneumatic	157	39	–
Industrial Trucks	1,441	405	14
Lift	1,193	353	14
Truck-tractor	124	33	–
Powered hand trucks	81	–	–
Crane	43	19	–

PHILADELPHIA--Camden...Allentown-Bethlehem...

Scranton-Wilkes-Barre



These three marketing areas include Burlington, Camden, and Gloucester counties in N. J.; and Bucks, Chester, Delaware, Montgomery, Philadelphia, Berks, Lehigh, Northampton, Lackawanna, and Luzerne counties in Pa.

897 plants, 267,659 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	73,941	43%	22%
Metal Forming	21,879	55	30
Other Equip.	47,223	39	13
Total	143,043	43	20

	TOTAL	10-20 YEARS	OVER 20 YR
MACHINE TOOLS	73,941	15,224	16,437
Boring Machines	2,562	629	719
Horizontal boring, drilling, and milling	872	266	282
Vertical boring mills including vertical turret lathes	1,059	275	294
Precision, horizontal and vertical	80	16	–
Jig boring, horizontal and vertical	103	32	4
Other	388	45	139
Broaching Machines	347	108	70
Horizontal internal	103	28	20
Horizontal surface	28	8	4
Vertical internal	60	16	15
Vertical surface	87	41	8
Other	69	15	23
Contour sawing and filing	365	60	40
Cutoff Machines	4,354	799	550
Bandsaw	1,096	183	85
Abrasive disk	627	181	20
Hacksaws	1,505	244	260
Rotary, hot or cold	800	119	98
Other	326	72	76
Drilling Machines	14,533	3,056	2,681
Sensitive	2,222	361	246
Upright: Single-spindle	6,911	1,231	1,280
Gang	2,475	755	537
Radial	1,678	465	504
Multi-spindle cluster, adjustable & fixed center	345	83	103
Unit head and way type, multi-spindle	167	36	32
Deep-hole drills	40	24	4
Other	695	196	165
Gear Cutting and Finishing Machines	882	159	285
Hobbing machines	281	37	83
Shapers, gear	202	52	75
Cutters, form-milling type	179	8	61
Bevel gear cutters (not planer)	40	4	16
Cutters, planer type	4	–	4
Grinders, gear	16	–	–
Shavers, gear	36	4	–
Burnishing and lapping	30	8	4
Chamfering, tooth pointing, tooth rounding	12	–	4
Other	102	12	8
Gear Checking Machines	64	4	4
Grinding Machines	15,330	3,312	2,527
External cylindrical, plain and universal	1,170	257	190
Internal cylindrical	347	79	75
Centerless: External	277	45	36
Internal	28	14	–
Surface: Rotary table type	401	72	84
Reciprocating type	1,497	222	167
Disk, horizontal and vertical	384	102	115
Tool and cutter	2,469	531	425
Bench, floor-stand, and swing	5,629	1,116	1,106
Abrasive belt (not polishing)	638	135	36
Other	1,571	441	304
Honing and Lapping	512	103	54
Honing	218	36	12
Lapping: External	190	57	42
Internal	81	12	–
Surface	28	4	–
Lathes	18,763	3,842	4,313
Bench and floor, light-duty	3,559	512	975
Engine, heavy-duty, incl toolroom, trig, tool room, gap	5,709	1,140	2,124
Turret lathes: Ram type and hand screw	2,606	574	643
Saddle type	997	237	295
Automatic chucking, horizontal and vertical	555	151	127
Automatic between centers chucking	206	40	6
Automatic screw machines, bar	1,415	493	336
Gun and shaft boring	12	–	4
Other	508	95	103
Milling Machines	9,744	1,743	1,776
Bench type	274	71	28
Hand	648	135	169
Knee-type, horizontal	2,854	607	527
Vertical	972	242	178
Automatic and manufacturing	459	99	52
Bed (Lincoln) type, incl automatic rise and fall	151	44	20
Planer type	74	40	12
Die sinkers (except engraving) & duplicators	12	4	8
Other	461	137	83
Planers	840	174	417
Double housing	437	95	250
Openside	268	67	123
Other	135	12	44
Pipe Cutting and Threading Machines	1,790	335	195
Polishing and Buffing Machines	3,631	754	838
Speed lathes	1,328	335	464
Polishing stands	1,245	338	322
Abrasive belt	959	293	44
Other	100	28	8
Rifle Boring Machines (not deep-hole drills)	6	–	–
Shapers	2,144	545	775
Horizontal	1,702	457	516
Vertical, including slotters	151	44	115
Keyseaters	131	24	44
Threading (except pipe)	1,899	286	879
Tapping	449	83	44
Hobbing and milling	159	44	28
Die type	341	127	21
Grinders, thread	48	8	–
Rolling machines, thread	147	9	48
Other	755	16	660
Other Machine Tools	1,167	115	774
METAL FORMING MACHINERY	21,879	5,490	6,530
Bending and Forming Machines	2,632	551	843
Bending rolls, sheet and plate	830	206	358
Bending rolls, bars and shapes	406	111	175
Power bending brakes	592	111	48
Rotary forming machines	85	12	16
Bending machines, pipe and bar	234	32	36
Other	377	79	250
Hydraulic Presses	1,616	216	652
Vertical, single action	969	160	318
Vertical, double and triple action	218	20	111
Horizontal	246	20	179
Other (including hydro-pneumatic)	183	16	44
Pneumatic Presses (except hydro-pneumatic)	83	8	16
Mechanical Presses, Power Driven	10,767	3,174	2,637
Inclinable	4,684	2,056	870
Vertical, Coldacer	1,191	453	425
Vertical, straight-sided	3,745	605	1,106
Dining machines	48	12	20
Horizontal	107	16	36
Other	592	32	171
Punching and Shearing Machines	3,347	830	1,033
Punching machines	1,167	269	432
Plate and sheet shears	1,115	282	294
Bar and angle shears	369	60	159
Rotary shears	222	67	87
Other	254	52	60
Forging Machines (except presses)	1,555	217	752
Hammers, steam or air	418	74	171
Hammers, gravity drop	232	48	111
Hammers, helve	142	24	80
Forging machines (headers) and rolls	569	75	275
Other	195	26	115
Swaging Machines	260	40	128
Wire and Strip Forming Machines	239	144	75
Die Casting Machines	223	48	6
Hot chamber	91	44	4
Cold chamber	132	–	–
Plastic Molding Machines	171	–	28
Injection	40	–	–
Compression	131	–	28
Riveting Machines (Not Portable)	1,386	262	362
OTHER SHOP EQUIPMENT	47,223	12,185	6,108
Electric Welding Machines (Not Hand)	6,540	3,161	421
Arc: Motor-generator set	4,582	2,255	205
Transformer	1,334	159	8
Automatic and other	361	107	8
Resistance: Spot	1,580	865	84
Projection	187	71	–
Butt	93	–	–
Seam	83	32	–
Butt and flash	282	91	111
Gas Welding, Cutting Machines (Not Hand)	1,109	203	32
Flame cutting	854	159	24
Rolling	185	44	8
Balancing Machines	266	36	66
Air Compressors	1,715	290	230
Plating Equipment	2,028	421	93
Machine	599	28	8
Tanks	1,401	314	83
Barrels	562	79	4
Materials Heating Equipment	4,691	1,008	735
Heat-treating furnaces	2,862	690	401
Stock-heating furnaces	1,429	251	176
Salt baths	269	52	56
Induction heating units	265	13	–
Baking and drying ovens	806	167	119
Flame hardening	28	10	3
Cleaning Equipment	5,138	1,130	482
Tumbling barrels	1,610	464	190
Shot and abrasive blast	1,967	448	239
Parts washing machines	974	97	29
Pickling machines	93	12	–
Tanks	744	273	16
Cranes, Overhead Traveling	9,238	748	1,570
Hoists (Incl. Jib and Rail Mounting)	16,046	4,339	2,238
Chain, hand	10,870	2,506	1,554
Electric	4,457	1,565	568
Pneumatic	719	268	39
Industrial Trucks	8,450	689	241
Lift	2,950	504	133
Truck-tractor	695	86	82
Powered hand trucks	440	57	*
Crane	114	5	17

PITTSBURGH and WHEELING

365 plants, 142,235 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**28,058**	**54%**	**27%**
Metal Forming	**12,993**	**63**	**38**
Other Equip.	**22,503**	**42**	**16**
Total	**63,554**	**52**	**26**

These two marketing areas include Allegheny, Beaver, Washington, and Westmoreland counties in Pennsylvania; Brooke, Hancock, and Ohio counties in West Virginia; and Belmont, Columbiana, and Jefferson counties in Ohio

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	28,058	7,474	7,774
Boring Machines	1,413	352	440
Horizontal boring, drilling, and milling	556	154	132
Vertical boring mills including vertical turret lathes	707	163	300
Precision, horizontal and vertical	22	–	–
Jig boring, horizontal and vertical	119	31	4
Other	9	4	4
Broaching Machines	96	30	21
Horizontal internal	44	18	4
Horizontal surface	–	–	–
Vertical internal	4	4	–
Vertical surface	35	4	13
Other	13	4	4
Contour sawing and filing	225	71	13
Cutoff Machines	2,445	536	406
Bandsaw	792	106	128
Abrasive disk	101	22	4
Hacksaws	823	251	97
Rotary, hot or cold	376	73	159
Other	353	84	18
Drilling Machines	4,001	954	1,358
Sensitive	1,261	234	573
Upright: Single-spindle	1,264	340	348
Gang	221	49	53
Radial	955	260	362
Multi-spindle cluster, adjustable & fixed center	84	9	9
Unit head and way type, multi-spindle	26	–	–
Deep-hole drills	–	–	–
Other	190	62	13
Gear Cutting and Finishing Machines	439	105	198
Hobbing machines	238	66	115
Shapers, gear	15	9	4
Cutters, form-milling type	101	4	79
Bevel gear cutters (not planer)	22	9	–
Cutters, planer type	–	–	–
Grinders, gear	39	9	–
Shavers, gear	18	4	–
Burnishing and lapping	4	4	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	9	–	–
Gear Checking Machines	40	13	–
Grinding Machines	4,612	1,325	836
External cylindrical, plain and universal	328	119	97
Internal cylindrical	163	44	31
Centerless: External	97	22	9
Internal	7	–	2
Surface: Rotary table type	115	53	9
Reciprocating type	666	137	79
Disk, horizontal and vertical	260	26	93
Tool and cutter	944	249	172
Bench, floor-stand, and snag	1,314	481	234
Abrasive belt (not polishing)	154	22	–
Other	584	172	110
Honing and Lapping	119	13	13
Honing	93	9	13
Lapping: External	13	–	–
Internal	4	4	–
Surface	9	–	–
Lathes	6,569	1,845	2,037
Bench and floor, light-duty	942	260	298
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	2,421	714	833
Turret lathes: Ram type and hand screw	498	128	137
Saddle type	704	172	101
Automatic chucking, horizontal and vertical	88	13	31
Automatic between centers (bar)	40	9	26
Automatic screw machines, bar	629	231	71
Gun and shaft boring	–	–	–
Other	1,247	318	540
Milling Machines	2,709	649	556
Bench type	22	9	–
Hand	287	40	71
Knee-type, horizontal	1,023	247	238
Vertical	257	190	137
Automatic and manufacturing	84	–	4
Bed (Lincoln) type, incl automatic rise and fall	60	9	4
Planer type	97	57	18
Die sinkers (except engraving) & duplicators	102	18	4
Other	387	79	80
Planers	432	124	212
Double housing	291	53	172
Openside	119	53	40
Other	22	18	–
Pipe Cutting and Threading Machines	423	181	79
Polishing and Buffing Machines	1,515	556	251
Speed lathes	379	265	40
Polishing stands	691	194	101
Abrasive belt	335	75	44
Other	110	22	66
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	1,036	305	428
Horizontal	714	221	291
Vertical, including slotters	212	49	88
Keyseaters	110	35	49
Threading (except pipe)	1,190	247	653
Tapping	564	75	322
Hobbing and milling	66	18	18
Die type	291	79	159
Grinders, thread	22	4	–
Rolling machines, thread	243	71	150
Other	4	–	4
Other Machine Tools	794	168	273
METAL FORMING MACHINERY	12,993	3,218	4,902
Bending and Forming Machines	1,451	371	691
Bending rolls, sheet and plate	379	141	132
Bending rolls, bars and shapes	556	106	392
Power bending brakes	331	75	79
Rotary forming machines	79	22	44
Bending machines, pipe and bar	44	18	13
Other	62	9	31
Hydraulic Presses	2,473	574	729
Vertical, single action	2,328	526	685
Vertical, double and triple action	44	13	9
Horizontal	88	35	31
Other (including hydro-pneumatic)	13	–	4
Pneumatic Presses (except hydro-pneumatic)	13	–	–
Mechanical Presses, Power Driven	4,602	991	1,720
Inclinable	2,996	582	1,094
Vertical, C-frame	323	75	118
Vertical, straight-sided	560	198	234
Dieing machines	4	4	–
Horizontal	44	13	9
Other	675	119	265
Punching and Shearing Machines	1,525	463	524
Punching machines	370	123	185
Plate and sheet shears	366	141	110
Bar and angle shears	172	62	79
Rotary shears	194	44	9
Other	423	93	141
Forging Machinery (except presses)	1,214	218	757
Hammers, steam or air	146	13	119
Hammers, gravity drop	77	4	18
Hammers, helve	150	18	110
Forging machines (headers) and rolls	788	179	484
Other	53	4	26
Swaging Machines	101	26	49
Wire and Strip Forming Machines	585	188	198
Die Casting Machines	57	40	18
Hot chamber	57	40	18
Cold chamber	–	–	–
Plastic Molding Machines	756	307	93
Injection	–	–	–
Compression	756	307	93
Riveting Machines (Not Portable)	216	40	123
OTHER SHOP EQUIPMENT	22,503	5,934	3,544
Electric Welding Machines (Not Hand)	6,696	1,961	455
Arc: Motor-generator set	3,554	1,173	225
Transformer	1,652	437	119
Automatic and other	239	35	–
Resistance: Spot	891	259	93
Projection	57	13	–
Gun	101	9	–
Seam	109	22	–
Butt and flash	93	13	18
Gas Welding, Cutting Machines (Not Hand)	556	212	4
Flame cutting	503	194	4
Welding	53	18	–
Balancing Machines	150	57	26
Air Compressors	1,356	287	339
Plating Equipment	915	217	49
Machines	185	71	31
Tanks	537	106	9
Barrels	193	40	9
Materials Heating Equipment	3,353	1,190	574
Heat-treating furnaces	1,138	490	159
Stock-heating furnaces	516	207	84
Salt baths	146	84	9
Induction heating units	75	13	–
Baking and drying ovens	1,469	392	322
Flame hardening	9	4	–
Cleaning Equipment	1,221	252	131
Tumbling barrels	322	128	66
Shot and abrasive blast	234	40	26
Parts washing machines	300	49	13
Pickling machines	31	9	8
Tanks	334	26	18
Cranes, Overhead Traveling	2,368	410	1,120
Hoists (Incl. Jib and Rail Mounting)	3,965	970	489
Chain, hand	1,288	459	207
Electric	2,448	454	282
Pneumatic	229	57	–
Industrial Trucks	1,923	378	357
Lift	1,526	347	344
Truck-tractor	181	9	–
Powered hand trucks	123	4	–
Crane	92	18	13

MIDDLE ATLANTIC STATES

1177 plants, 364,982 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**130,111**	**43%**	**26%**
Metal Forming	**30,065**	**51**	**31**
Other Equip.	**68,064**	**36**	**19**
Total	**228,240**	**42**	**24**

This area includes New York, New Jersey, and Pennsylvania except those counties listed in other tables

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	130,111	24,659	31,391
Boring Machines	5,387	906	1,812
Horizontal boring, drilling, and milling	1,950	295	677
Vertical boring mills including vertical turret lathes	2,224	390	1,051
Precision, horizontal and vertical	219	108	29
Jig boring, horizontal and vertical	462	113	45
Other	32	–	10
Broaching Machines	847	116	60
Horizontal internal	312	71	41
Horizontal surface	57	7	13
Vertical internal	83	14	3
Vertical surface	174	21	7
Other	21	3	–
Contour sawing and filing	508	106	24
Cutoff Machines	5,613	1,265	887
Bandsaw	2,072	309	187
Abrasive disk	777	139	28
Hacksaws	2,190	676	620
Rotary, hot or cold	400	61	180
Other	174	80	62
Drilling Machines	25,499	4,687	5,468
Sensitive	7,349	761	1,226
Upright: Single-spindle	8,532	1,847	1,941
Gang	2,844	489	575
Radial	3,548	857	1,049
Multi-spindle cluster, adjustable & fixed center	1,045	316	156
Unit head and way type, multi-spindle	271	31	10
Deep-hole drills	192	69	24
Other	1,718	337	485
Gear Cutting and Finishing Machines	2,383	455	556
Hobbing machines	770	191	174
Shapers, gear	508	115	90
Cutters, form-milling type	312	56	224
Bevel gear cutters (not planer)	423	42	10
Cutters, planer type	62	14	20
Grinders, gear	30	10	–
Shavers, gear	50	7	–
Burnishing and lapping	133	7	–
Chamfering, tooth pointing, tooth rounding	35	3	7
Other	59	10	31
Gear Checking Machines	316	68	19
Grinding Machines	26,820	5,213	4,776
External cylindrical, plain and universal	2,436	601	306
Internal cylindrical	938	172	102
Centerless: External	586	146	10
Internal	30	8	3
Surface: Rotary table type	1,161	309	163
Reciprocating type	3,244	628	337
Disk, horizontal and vertical	1,270	239	337
Tool and cutter	4,489	766	799
Bench, floor-stand, and snag	9,455	1,797	2,310
Abrasive belt (not polishing)	1,619	287	97
Other	1,592	260	312
Honing and Lapping	1,051	202	17
Honing	603	102	–
Lapping: External	146	62	3
Internal	198	31	14
Surface	104	7	–
Lathes	28,776	5,673	8,240
Bench and floor, light-duty	5,595	756	1,317
Engine, heavy-duty, incl toolrm, mfg. sur form, gap	10,652	2,117	4,574
Turret lathes: Ram type and hand screw	5,324	1,505	963
Saddle type	1,563	348	274
Automatic chucking, horizontal and vertical	1,053	221	135
Automatic between centers chucking	226	46	17
Automatic screw machines, bar	3,477	670	593
Gun and shaft boring	362	17	121
Other	424	62	246
Milling Machines	15,243	2,919	3,383
Bench type	715	97	80
Hand	1,744	456	460
Knee-type, horizontal	5,617	1,184	1,312
Vertical	2,881	437	551
Automatic and manufacturing	1,280	257	285
Bed (Lincoln) type, incl automatic rise and fall	1,191	190	302
Planer type	297	60	121
Die sinkers (except engraving) & duplicators	680	62	77
Other	838	168	195
Planers	1,665	152	1,084
Double housing	1,109	121	891
Openside	219	21	108
Other	137	10	85
Pipe Cutting and Threading Machines	1,038	219	436
Polishing and Buffing Machines	5,336	862	1,164
Speed lathes	1,243	200	388
Polishing stands	2,375	412	745
Abrasive belt	1,252	212	17
Other	468	38	14
Rifle Working Machines (not deep-hole drills)	144	3	14
Shapers	4,262	916	1,858
Horizontal	3,019	669	1,310
Vertical, including slotters	899	152	409
Keyseaters	344	94	139
Threading (except pipe)	3,946	756	1,329
Tapping	1,522	201	411
Hobbing and milling	452	104	90
Die type	694	278	187
Grinders, thread	255	24	14
Rolling machines, thread	318	104	124
Other	605	45	503
Other Machine Tools	1,277	139	264
METAL FORMING MACHINERY	30,065	6,114	9,252
Bending and Forming Machines	3,625	688	898
Bending rolls, sheet and plate	748	149	312
Bending rolls, bars and shapes	198	49	45
Power bending brakes	884	163	97
Rotary forming machines	551	108	111
Bending machines, pipe and bar	492	59	115
Other	752	160	218
Hydraulic Presses	2,807	303	781
Vertical, single action	2,067	199	556
Vertical, double and triple action	210	10	56
Horizontal	239	56	118
Other (including hydro-pneumatic)	291	38	51
Pneumatic Presses (except hydro-pneumatic)	589	31	43
Mechanical Presses, Power Driven	13,368	3,131	3,829
Inclinable	5,807	1,226	1,500
Vertical, C-frame	2,772	921	901
Vertical, straight-sided	2,811	613	1,112
Dieing machines	294	31	14
Horizontal	90	21	42
Other	1,594	319	260
Punching and Shearing Machines	3,986	800	1,669
Punching machines	1,067	184	573
Plate and sheet shears	1,432	349	516
Bar and angle shears	504	83	229
Rotary shears	396	87	132
Other	587	97	219
Forging Machinery (except presses)	1,993	241	1,267
Hammers, steam or air	586	49	430
Hammers, gravity drop	773	112	523
Hammers, helve	151	21	99
Forging machines (headers) and rolls	398	38	173
Other	85	21	42
Swaging Machines	294	128	80
Wire and Strip Forming Machines	633	290	228
Die Casting Machines	584	–	13
Hot chamber	260	–	10
Cold chamber	324	–	3
Plastic Molding Machines	367	204	35
Injection	7	–	–
Compression	360	204	35
Riveting Machines (Not Portable)	1,819	298	409
OTHER SHOP EQUIPMENT	68,064	11,515	13,251
Electric Welding Machines (Not Hand)	11,507	2,084	575
Arc: Motor-generator set	4,610	958	205
Transformer	1,566	103	3
Automatic and other	208	21	–
Resistance: Spot	3,600	766	264
Projection	652	49	7
Gun	159	7	–
Seam	245	49	44
Butt and flash	367	111	52
Gas Welding, Cutting Machines (Not Hand)	846	152	36
Flame cutting	682	135	29
Welding	164	17	7
Balancing Machines	349	69	57
Air Compressors	2,517	503	516
Plating Equipment	3,774	710	76
Machines	274	35	17
Tanks	2,681	516	14
Barrels	819	159	45
Materials Heating Equipment	9,328	2,044	1,567
Heat-treating furnaces	4,104	995	568
Stock-heating furnaces	1,748	491	704
Salt baths	551	87	26
Induction heating units	394	17	7
Baking and drying ovens	2,423	430	232
Flame hardening	108	24	28
Cleaning Equipment	6,793	1,247	1,314
Tumbling barrels	2,193	502	1,188
Shot and abrasive blast	1,264	174	246
Parts washing machines	723	118	31
Pickling machines	144	3	7
Tanks	1,469	450	42
Cranes, Overhead Traveling	5,135	489	4,049
Hoists (Incl. Jib and Rail Mounting)	21,175	3,024	4,622
Chain, hand	5,625	1,490	956
Electric	13,603	1,072	3,402
Pneumatic	1,947	462	264
Industrial Trucks	6,640	1,193	239
Lift	4,127	655	156
Truck-tractor	1,206	104	45
Powered hand trucks	836	209	–
Crane	451	125	38

BALTIMORE

141 plants, 57,979 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	7,423	39%	13%
Metal Forming	1,629	36	15
Other Equip.	4,097	19	4
Total	13,149	32	10

This marketing area includes Baltimore City and Baltimore County, Maryland

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	7,423	1,951	929
Boring Machines	356	77	50
Horizontal boring, drilling, and milling	41	12	3
Vertical boring mills including vertical turret lathes	255	44	41
Precision, horizontal and vertical	9	3	3
Jig boring, horizontal and vertical	36	9	3
Other	15	9	–
Broaching Machines	27	6	3
Horizontal internal	15	6	3
Horizontal surface	–	–	–
Vertical internal	12	–	–
Vertical surface	–	–	–
Other	–	–	–
Contour sawing and filing	15	–	–
Cutoff Machines	560	129	9
Bandsaw	296	59	3
Abrasive disk	33	6	–
Hacksaws	80	23	3
Rotary, hot or cold	6	3	–
Other	145	38	3
Drilling Machines	1,344	406	104
Sensitive	290	33	9
Upright: Single-spindle	698	261	44
Gang	124	62	27
Radial	107	44	12
Multi-spindle cluster, adjustable & fixed center	86	6	6
Unit head and way type, multi-spindle	6	–	6
Deep-hole drills	–	–	–
Other	33	–	–
Gear Cutting and Finishing Machines	80	12	33
Hobbing machines	24	–	6
Shapers, gear	41	6	24
Cutters, form-milling type	6	3	3
Bevel gear cutters (not planer)	9	3	–
Cutters, planer type	–	–	–
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	24	9	3
Grinding Machines	1,486	554	120
External cylindrical, plain and universal	121	24	18
Internal cylindrical	30	9	9
Centerless: External	18	6	–
Internal	–	–	–
Surface: Rotary table type	124	18	27
Reciprocating type	98	33	9
Disk, horizontal and vertical	110	77	6
Tool and cutter	216	86	21
Bench, floorstand, and snag	574	274	27
Abrasive belt (not polishing)	192	27	–
Other	3	–	3
Honing and Lapping	84	–	21
Honing	21	–	3
Lapping: External	33	–	18
Internal	–	–	–
Surface	30	–	–
Lathes	1,582	255	353
Bench and floor, light-duty	246	29	27
Engine, heavy-duty, incl toolroom, mfg, and form, gap	610	110	299
Turret lathes: Ram type and hand screw	255	36	18
Saddle type	21	12	–
Automatic chucking, horizontal and vertical	139	18	3
Automatic between centers chucking	172	–	–
Automatic screw machines, bar	124	38	6
Gun and shaft boring	–	–	–
Other	15	12	–
Milling Machines	1,158	356	140
Bench type	198	53	–
Hand	151	33	68
Knee-type, horizontal	355	136	33
Vertical	385	116	33
Automatic and manufacturing	7	3	–
Bed (Lincoln) type, incl automatic rise and fall	27	6	–
Planer type	18	3	6
Die sinkers (except engraving) & duplicators	6	–	–
Other	15	6	–
Planers	39	15	21
Double housing	21	3	18
Openside	18	12	3
Other	–	–	–
Pipe Cutting and Threading Machines	44	13	6
Polishing and Buffing Machines	288	15	9
Speed lathes	33	–	3
Polishing stands	145	12	6
Abrasive belt	101	3	–
Other	9	–	–
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	244	58	42
Horizontal	196	38	27
Vertical, including slotters	33	20	3
Keyseaters	15	–	12
Threading (except pipe)	92	46	15
Tapping	56	33	6
Hobbing and milling	9	–	6
Die type	12	3	3
Grinders, thread	12	9	–
Rolling machines, thread	3	–	–
Other	–	1	–
Other Machine Tools	–	–	–
METAL FORMING MACHINERY	1,629	343	250
Bending and Forming Machines	188	51	15
Bending rolls, sheet and plate	36	9	15
Bending rolls, bars and shapes	6	–	–
Power bending brakes	104	24	–
Rotary forming machines	–	–	–
Bending machines, pipe and bar	18	9	–
Other	24	9	–
Hydraulic Presses	77	15	9
Vertical, single action	50	12	3
Vertical, double and triple action	6	–	–
Horizontal	21	3	6
Other (including hydro-pneumatic)	–	–	–
Pneumatic Presses (except hydro-pneumatic)	44	15	–
Mechanical Presses, Power Driven	428	92	125
Inclinable	189	56	68
Vertical, C-frame	168	15	33
Vertical, straight-sided	59	21	21
Dieing machines	3	–	–
Horizontal	3	–	3
Other	6	–	–
Punching and Shearing Machines	264	57	83
Punching machines	77	24	33
Plate and sheet shears	154	18	50
Bar and angle shears	18	9	–
Rotary shears	9	6	–
Other	6	–	–
Forging Machinery (except presses)	127	33	9
Hammers, steam or air	62	21	6
Hammers, gravity drop	62	12	–
Hammers, helve	3	–	3
Forging machines (headers) and rolls	–	–	–
Other	–	–	–
Swaging Machines	9	–	–
Wire and Strip Forming Machines	3	–	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	12	–	–
Injection	3	–	–
Compression	9	–	–
Riveting Machines (Not Portable)	477	80	9
OTHER SHOP EQUIPMENT	4,097	614	180
Electric Welding Machines (Not Hand)	534	183	15
Arc: Motor-generator set	231	112	–
Transformer	24	3	3
Automatic and other	12	–	–
Resistance: Spot	234	68	9
Projection	–	–	–
Gun	12	–	–
Seam	12	–	–
Butt and flash	9	–	3
Gas Welding, Cutting Machines (Not Hand)	86	21	–
Flame cutting	56	12	–
Welding	30	9	–
Balancing Machines	21	–	6
Air Compressors	519	62	27
Plating Equipment	556	12	–
Machines	62	–	–
Tanks	456	12	–
Barrels	38	–	–
Materials Heating Equipment	400	89	15
Heat-treating furnaces	246	77	12
Stock-heating furnaces	53	–	–
Salt baths	30	–	–
Induction heating units	21	–	–
Baking and drying ovens	47	12	3
Flame hardening	3	–	–
Cleaning Equipment	180	32	18
Tumbling barrels	27	–	3
Shot and abrasive blast	30	9	3
Parts washing machines	38	3	–
Pickling machines	–	–	–
Tanks	65	21	12
Cranes, Overhead Traveling	212	11	67
Hoists (Incl. Jib and Rail Mounting)	1,271	159	32
Chain, hand	964	113	21
Electric	307	46	11
Pneumatic	–	–	–
Industrial Trucks	318	44	–
Lift	162	40	–
Truck-tractor	74	4	–
Powered hand trucks	64	–	–
Crane	18	–	–

SOUTHERN STATES

1253 plants, 281,868 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**135,028**	**35%**	**7%**
Metal Forming	**28,610**	**51**	**22**
Other Equip.	**63,940**	**36**	**7**
Total	**227,578**	**37**	**9**

This area includes Maryland, Delaware, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, and Mississippi except counties included in other tables

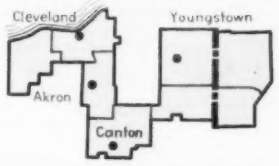
	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	135,028	37,775	10,074
Boring Machines	4,643	1,043	676
Horizontal boring, drilling, and milling	1,517	447	107
Vertical boring mills including vertical turret lathes	1,741	461	490
Precision, horizontal and vertical	707	73	17
Jig boring, horizontal and vertical	312	22	17
Other	366	40	45
Broaching Machines	932	146	30
Horizontal internal	321	79	17
Horizontal surface	60	6	–
Vertical internal	111	28	13
Vertical surface	193	33	–
Other	247	–	–
Contour sawing and filing	1,040	312	76
Cutoff Machines	7,514	2,062	382
Bandsaw	2,036	460	56
Abrasive disk	1,839	172	11
Hacksaws	2,750	1,176	141
Rotary, hot or cold	617	243	118
Other	272	11	56
Drilling Machines	23,778	7,209	1,467
Sensitive	10,772	3,424	270
Upright: Single-spindle	6,709	2,001	636
Gang	898	271	99
Radial	2,713	810	332
Multi-spindle cluster, adjustable & fixed center	909	275	90
Unit head and way type, multi-spindle	448	118	6
Deep-hole drills	412	90	11
Other	917	220	23
Gear Cutting and Finishing Machines	2,763	757	277
Hobbing machines	925	275	152
Shapers, gear	650	169	51
Cutters, form-milling type	211	172	28
Bevel gear cutters (not planer)	395	84	34
Cutters, planer type	50	23	6
Grinders, gear	301	20	–
Shavers, gear	69	17	–
Burnishing and lapping	85	6	–
Chamfering, tooth pointing, tooth rounding	44	–	–
Other	33	11	6
Gear Checking Machines	290	135	–
Grinding Machines	28,517	8,748	1,292
External cylindrical, plain and universal	2,685	839	56
Internal cylindrical	1,331	170	39
Centerless: External	372	28	–
Internal	36	9	11
Surface: Rotary table type	764	169	28
Reciprocating type	2,210	602	62
Disk, horizontal and vertical	763	236	11
Tool and cutter	4,934	1,200	281
Bench, floor-stand, and snag	12,457	4,882	781
Abrasive belt (not polishing)	888	68	–
Other	2,077	545	17
Honing and Lapping	1,228	199	45
Honing	817	156	–
Lapping: External	226	37	45
Internal	71	–	–
Surface	104	6	–
Lathes	33,308	8,723	2,789
Bench and floor, light-duty	7,337	2,548	445
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	11,146	3,398	1,462
Turret lathes: Ram type and hand screw	2,619	703	186
Saddle type	2,188	725	174
Automatic chucking, horizontal and vertical	766	118	22
Automatic between centers chucking	519	73	6
Automatic screw machines, bar	4,640	938	263
Gun and shaft boring	264	19	103
Other	2,831	201	128
Milling Machines	13,385	3,874	826
Bench type	1,200	473	28
Hand	620	118	155
Knee-type, horizontal	4,703	1,652	392
Vertical	2,761	698	52
Automatic and manufacturing	844	135	6
Bed (Lincoln) type, incl automatic rise and fall	804	170	34
Planer type	222	84	28
Die sinkers (except engraving) & duplicators	881	284	75
Other	850	260	56
Planers	1,475	355	578
Double housing	903	226	447
Openside	375	107	35
Other	197	22	96
Pipe Cutting and Threading Machines	1,722	797	153
Polishing and Buffing Machines	6,545	1,237	419
Speed lathes	2,315	298	146
Polishing stands	2,908	737	212
Abrasive belt	1,061	180	22
Other	241	22	39
Rifle Working Machines (not deep-hole drills)	185	24	12
Shapers	3,740	1,237	622
Horizontal	2,697	968	448
Vertical, including slotters	741	172	84
Keyseaters	302	97	90
Threading (except pipe)	3,505	878	385
Tapping	1,638	433	51
Hobbing and milling	878	220	28
Die type	406	180	67
Grinders, thread	217	–	–
Rolling machines, thread	37	6	–
Other	329	39	239
Other Machine Tools	458	39	45
METAL FORMING MACHINERY	28,610	8,272	6,182
Bending and Forming Machines	5,916	2,314	853
Bending rolls, sheet and plate	1,555	625	455
Bending rolls, bars and shapes	255	73	128
Power bending brakes	1,014	312	118
Rotary forming machines	480	170	34
Bending machines, pipe and bar	679	277	45
Other	1,933	857	73
Hydraulic Presses	3,429	710	434
Vertical, single action	2,060	492	186
Vertical, double and triple action	185	56	45
Horizontal	469	84	152
Other (including hydro-pneumatic)	706	78	51
Pneumatic Presses (except hydro-pneumatic)	705	175	6
Mechanical Presses, Power Driven	8,981	1,974	2,212
Inclinable	3,696	1,205	706
Vertical, C-frame	1,649	410	377
Vertical, straight-sided	2,243	247	699
Dieing machines	219	45	6
Horizontal	116	22	39
Other	958	45	185
Punching and Shearing Machines	5,305	1,865	1,517
Punching machines	1,898	582	837
Plate and sheet shears	2,093	776	371
Bar and angle shears	522	170	180
Rotary shears	399	180	101
Other	393	157	28
Forging Machinery (except presses)	1,531	435	786
Hammers, steam or air	566	160	302
Hammers, gravity drop	329	150	151
Hammers, helve	170	34	120
Forging machines (headers) and rolls	247	72	157
Other	209	19	56
Swaging Machines	78	34	11
Wire and Strip Forming Machines	901	485	22
Die Casting Machines	124	–	–
Hot chamber	11	–	–
Cold chamber	113	–	–
Plastic Molding Machines	238	50	84
Injection	59	22	–
Compression	179	28	84
Riveting Machines (Not Portable)	1,502	230	257
OTHER SHOP EQUIPMENT	63,940	18,368	4,388
Electric Welding Machines (Not Hand)	12,189	4,087	431
Arc: Motor-generator set	6,628	2,493	287
Transformer	1,850	333	17
Automatic and other	686	552	–
Resistance: Spot	1,782	440	62
Projection	349	90	6
Gun	364	22	–
Seam	241	28	25
Butt and flash	289	129	34
Gas Welding, Cutting Machines (Not Hand)	1,458	375	17
Flame cutting	1,099	306	11
Welding	359	69	6
Balancing Machines	258	90	6
Air Compressors	2,746	567	289
Plating Equipment	3,380	974	51
Machines	331	39	–
Tanks	2,775	929	45
Barrels	274	6	6
Materials Heating Equipment	9,264	2,745	861
Heat-treating furnaces	2,926	736	282
Stock-heating furnaces	2,241	754	253
Salt baths	652	102	–
Induction heating units	254	12	–
Baking and drying ovens	3,075	1,129	326
Flame hardening	116	12	–
Cleaning Equipment	6,633	1,517	358
Tumbling barrels	1,512	364	274
Shot and abrasive blast	1,331	261	11
Parts washing machines	2,389	661	6
Pickling machines	53	–	–
Tanks	1,348	231	67
Cranes, Overhead Traveling	2,079	354	793
Hoists (Incl. Jib and Rail Mounting)	17,047	5,474	1,285
Chain, hand	8,662	3,013	352
Electric	7,857	2,331	896
Pneumatic	528	130	37
Industrial Trucks	8,886	2,085	267
Lift	3,077	617	39
Truck-tractor	954	292	–
Powered hand trucks	2,484	609	–
Crane	2,371	567	228

CLEVELAND...Akron...Canton...Youngstown

930 plants, 279,063 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**92,300**	**39%**	**22%**
Metal Forming	**24,216**	**51**	**22**
Other Equip.	**46,899**	**27**	**9**
Total	**163,415**	**37**	**18**

These four marketing areas include Cuyahoga, Lorain, Summit, Stark, Mahoning, and Trumbull counties in Ohio; and Lawrence and Mercer counties in Pennsylvania



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	92,300	15,999	19,646
Boring Machines	3,499	645	680
Horizontal boring, drilling, and milling	1,344	309	297
Vertical boring mills including vertical turret lathes	1,316	183	315
Precision, horizontal and vertical	359	41	20
Jig boring, horizontal and vertical	354	61	44
Other	126	51	4
Broaching Machines	1,345	111	142
Horizontal internal	337	72	118
Horizontal surface	96	–	9
Vertical internal	422	4	4
Vertical surface	470	35	–
Other	20	–	11
Contour sawing and filing	155	16	–
Cutoff Machines	3,988	593	385
Bandsaw	1,307	138	106
Abrasive disk	541	81	8
Hacksaws	1,446	277	202
Rotary, hot or cold	342	77	53
Other	352	20	16
Drilling Machines	16,101	3,375	4,231
Sensitive	3,061	422	488
Upright: Single-spindle	6,001	1,523	1,936
Gang	2,990	641	965
Radial	2,162	391	460
Multi-spindle cluster, adjustable & fixed center	932	248	260
Unit head and way type, multi-spindle	425	69	28
Deep-hole drills	90	20	4
Other	440	61	90
Gear Cutting and Finishing Machines	2,165	355	686
Hobbing machines	786	114	260
Shapers, gear	549	102	163
Cutters, form-milling type	199	49	81
Bevel gear cutters (not planer)	182	20	66
Cutters, planer type	45	12	24
Grinders, gear	79	20	8
Shavers, gear	93	4	16
Burnishing and lapping	74	8	12
Chamfering, tooth pointing, tooth rounding	79	18	23
Other	79	8	33
Gear Checking Machines	244	25	25
Grinding Machines	21,370	3,560	2,247
External cylindrical, plain and universal	3,133	590	359
Internal cylindrical	956	154	154
Centerless: External	1,673	413	40
Internal	35	14	–
Surface: Rotary table type	875	130	134
Reciprocating type	2,462	309	330
Disk, horizontal and vertical	1,832	81	110
Tool and cutter	3,930	749	406
Bench, floorstand, and snag	4,540	904	592
Abrasive belt (not polishing)	603	37	4
Other	1,331	179	118
Honing and Lapping	823	57	28
Honing	399	41	12
Lapping: External	126	–	–
Internal	225	12	16
Surface	73	4	–
Lathes	20,502	3,151	5,886
Bench and floor, light-duty	2,005	313	279
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	6,997	1,258	2,677
Turret lathes: Ram type and hand screw	5,172	635	1,132
Saddle type	1,733	243	379
Automatic chucking, horizontal and vertical	657	130	118
Automatic between centers chucking	216	24	24
Automatic screw machines, bar	3,421	495	1,167
Gun and shaft boring	16	–	8
Other	285	53	102
Milling Machines	10,317	1,709	2,851
Bench type	252	77	12
Hand	1,497	466	356
Knee-type, horizontal	3,684	582	1,058
Vertical	1,612	265	228
Automatic and manufacturing	1,791	147	974
Bed (Lincoln) type, incl automatic rise and fall	669	53	49
Planer type	284	86	45
Die sinkers (except engraving) & duplicators	198	4	48
Other	330	49	81
Planers	750	142	326
Double housing	558	85	236
Openside	151	57	57
Other	41	–	33
Pipe Cutting and Threading Machines	623	151	61
Polishing and Buffing Machines	4,721	930	393
Speed lathes	1,201	147	151
Polishing stands	2,711	702	238
Abrasive belt	540	53	4
Other	269	28	–
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	2,342	670	657
Horizontal	1,821	552	507
Vertical, including slotters	317	69	73
Keyseaters	204	49	77

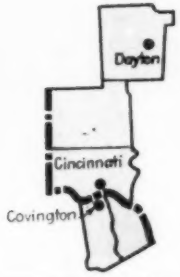
	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	2,879	415	991
Tapping	1,250	114	362
Hobbing and milling	315	48	138
Die type	262	45	49
Grinders, thread	230	27	4
Rolling machines, thread	377	181	114
Other	445	–	324
Other Machine Tools	476	94	57
METAL FORMING MACHINERY	24,216	7,320	5,578
Bending and Forming Machines	1,942	521	249
Bending rolls, sheet and plate	407	151	69
Bending rolls, bars and shapes	163	41	12
Power bending brakes	666	179	90
Rotary forming machines	210	20	8
Bending machines, pipe and bar	262	49	33
Other	234	81	37
Hydraulic Presses	1,242	143	89
Vertical, single action	974	90	53
Vertical, double and triple action	53	12	8
Horizontal	81	4	20
Other (including hydro-pneumatic)	134	37	12
Pneumatic Presses (except hydro-pneumatic)	163	8	4
Mechanical Presses, Power Driven	12,832	4,188	3,261
Inclinable	6,432	2,262	1,248
Vertical, C-frame	2,505	940	894
Vertical, straight-sided	3,203	759	924
Dieing machines	118	24	8
Horizontal	155	69	28
Other	419	134	159
Punching and Shearing Machines	2,995	971	765
Punching machines	1,368	521	366
Plate and sheet shears	1,042	299	204
Bar and angle shears	204	57	53
Rotary shears	247	70	105
Other	134	24	37
Forging Machinery (except presses)	1,545	422	500
Hammers, steam or air	585	27	170
Hammers, gravity drop	133	24	29
Hammers, helve	155	33	91
Forging machines (headers) and rolls	660	275	206
Other	212	53	4
Swaging Machines	131	4	20
Wire and Strip Forming Machines	1,424	766	342
Die Casting Machines	671	98	130
Hot chamber	534	98	130
Cold chamber	137	–	–
Plastic Molding Machines	355	4	4
Injection	190	–	–
Compression	165	4	4
Riveting Machines (Not Portable)	916	195	214
OTHER SHOP EQUIPMENT	46,899	8,381	4,399
Electric Welding Machines (Not Hand)	7,214	1,928	582
Arc: Motor-generator set	2,339	606	106
Transformer	989	45	12
Automatic and other	502	57	119
Resistance: Spot	2,462	851	240
Projection	289	118	24
Gun	37	8	–
Seam	77	49	–
Butt and flash	519	104	81
Gas Welding, Cutting Machines (Not Hand)	927	319	38
Flame cutting	448	81	14
Welding	479	238	24
Balancing Machines	403	53	16
Air Compressors	1,903	389	187
Plating Equipment	2,926	532	94
Machines	348	24	33
Tanks	2,091	363	53
Barrels	487	145	8
Materials Heating Equipment	6,191	897	710
Heat-treating furnaces	3,646	649	373
Stock-heating furnaces	924	95	285
Salt baths	540	73	28
Induction heating units	621	12	8
Baking and drying ovens	285	65	8
Flame hardening	175	8	8
Cleaning Equipment	3,639	501	499
Tumbling barrels	1,359	314	312
Shot and abrasive blast	729	49	94
Parts washing machines	680	73	73
Pickling machines	142	12	–
Tanks	729	53	20
Cranes, Overhead Traveling	2,962	517	807
Hoists (Incl. Jib and Rail Mounting)	15,699	2,176	1,255
Chain, hand	7,605	1,649	470
Electric	7,644	398	651
Pneumatic	450	129	134
Industrial Trucks	5,035	1,069	211
Lift	3,499	929	98
Truck-tractor	465	88	62
Powered hand trucks	688	5	10
Crane	383	47	41

CINCINNATI and DAYTON

435 plants, 140,995 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**32,863**	**46%**	**27%**
Metal Forming	**10,663**	**53**	**26**
Other Equip.	**17,599**	**39**	**13**
Total	**61,125**	**45**	**22**

These two marketing areas include Butler, Hamilton, and Montgomery counties in Ohio; and Campbell and Kenton counties in Kentucky



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	32,863	6,375	8,700
Boring Machines	1,231	308	196
Horizontal boring, drilling, and milling	357	77	85
Vertical boring mills including vertical turret lathes	270	42	68
Precision, horizontal and vertical	375	138	5
Jig boring, horizontal and vertical	174	35	27
Other	55	16	11
Broaching Machines	357	99	36
Horizontal internal	102	26	21
Horizontal surface	18	6	–
Vertical internal	13	5	5
Vertical surface	101	31	8
Other	123	31	2
Contour sawing and filing	200	26	19
Cutoff Machines	1,078	230	155
Bandsaw	351	64	53
Abrasive disk	114	13	6
Hacksaws	427	124	63
Rotary, hot or cold	151	26	27
Other	35	3	6
Drilling Machines	6,722	1,288	1,917
Sensitive	2,059	309	784
Upright: Single-spindle	1,417	296	291
Gang	1,562	327	433
Radial	790	166	148
Multi-spindle cluster, adjustable & fixed center	351	66	159
Unit head and way type, multi-spindle	105	32	28
Deep-hole drills	43	10	18
Other	295	82	56
Gear Cutting and Finishing Machines	918	195	282
Hobbing machines	178	90	89
Shapers, gear	110	37	26
Cutters, form-milling type	155	14	118
Bevel gear cutters (not planer)	47	13	14
Cutters, planer type	31	2	14
Grinders, gear	52	18	7
Shavers, gear	23	3	–
Burnishing and lapping	39	8	2
Chamfering, tooth pointing, tooth rounding	34	8	10
Other	8	2	2
Gear Checking Machines	109	24	6
Grinding Machines	6,993	1,294	1,287
External cylindrical, plain and universal	863	338	187
Internal cylindrical	377	93	55
Centerless: External	319	72	13
Internal	15	3	–
Surface: Rotary table type	335	81	35
Reciprocating type	895	174	95
Disk, horizontal and vertical	229	66	53
Tool and cutter	2,066	325	394
Bench, floor stand, and swing	1,499	279	412
Abrasive belt (not polishing)	195	26	34
Other	200	37	29
Honing and Lapping	252	66	9
Honing	121	11	2
Lapping: External	10	3	–
Internal	45	5	2
Surface	76	47	5
Lathes	7,282	1,381	2,572
Bench and floor, light-duty	952	166	309
Engine, heavy-duty, incl toolrm, nfg, aut form, gap	2,533	638	744
Turret lathes: Ram type and hand screw	1,335	209	212
Saddle type	465	72	50
Automatic chucking, horizontal and vertical	136	82	10
Automatic between centers chucking	26	6	2
Automatic screw machines, bar	1,702	166	1,232
Gun and shaft boring	13	–	2
Other	100	42	10
Milling Machines	3,797	609	1,053
Bench type	77	21	27
Hand	678	92	238
Knee-type, horizontal	1,298	214	427
Vertical	557	72	71
Automatic and manufacturing	489	98	69
Bed (Lincoln) type, incl automatic rise and fall	264	40	64
Planer type	53	5	6
Die sinkers (except engraving) & duplicators	19	3	–
Other	362	64	151
Planers	546	100	220
Double housing	456	82	206
Openside	79	18	6
Other	11	–	8
Pipe Cutting and Threading Machines	222	48	52
Polishing and Buffing Machines	1,218	247	194
Speed lathes	150	23	29
Polishing stands	802	163	159
Abrasive belt	155	35	3
Other	111	26	3
Rifle Boring Machines (not deep-hole drills)	5	–	–
Shapers	756	175	240
Horizontal	552	135	163
Vertical, including slotters	130	26	40
Keyseaters	74	14	37

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	940	238	281
Tapping	707	201	240
Hobbing and milling	81	14	10
Die type	47	8	18
Grinders, thread	42	2	–
Rolling machines, thread	42	11	5
Other	21	2	8
Other Machine Tools	237	47	121
METAL FORMING MACHINERY	10,663	2,839	2,737
Bending and Forming Machines	1,071	223	194
Bending rolls, sheet and plate	378	82	95
Bending rolls, bars and shapes	156	24	2
Power bending brakes	209	43	39
Rotary forming machines	60	16	14
Bending machines, pipe and bar	26	5	2
Other	242	53	42
Hydraulic Presses	430	69	81
Vertical, single action	296	50	60
Vertical, double and triple action	42	3	3
Horizontal	34	8	16
Other (including hydro-pneumatic)	58	8	2
Pneumatic Presses (except hydro-pneumatic)	39	2	18
Mechanical Presses, Power Driven	6,446	1,904	1,797
Inclinable	3,560	1,126	927
Vertical, C-frame	1,133	349	448
Vertical, straight-sided	1,299	309	320
Dieing machines	16	2	3
Horizontal	48	18	18
Other	390	100	81
Punching and Shearing Machines	861	199	238
Punching machines	385	81	84
Plate and sheet shears	378	92	119
Bar and angle shears	19	5	10
Rotary shears	42	16	14
Other	37	5	11
Forging Machinery (except presses)	183	40	42
Hammers, steam or air	48	10	14
Hammers, gravity drop	108	27	6
Hammers, helve	3	–	3
Forging machines (headers) and rolls	19	–	13
Other	5	3	2
Swaging Machines	56	23	3
Wire and Strip Forming Machines	198	27	68
Die Casting Machines	107	–	13
Hot chamber	81	–	13
Cold chamber	26	–	–
Plastic Molding Machines	95	35	–
Injection	10	–	–
Compression	85	35	–
Riveting Machines (Not Portable)	1,177	317	283
OTHER SHOP EQUIPMENT	17,599	4,584	2,267
Electric Welding Machines (Not Hand)	2,931	641	225
Arc: Motor-generator set	1,050	182	53
Transformer	198	14	2
Automatic and other	248	32	42
Resistance: Spot	865	227	111
Projection	241	127	3
Gun	18	–	–
Seam	76	18	–
Butt and flash	135	45	14
Gas Welding, Cutting Machines (Not Hand)	111	10	–
Flame cutting	93	10	–
Welding	18	–	–
Balancing Machines	171	55	3
Air Compressors	206	45	19
Plating Equipment	356	70	16
Machines	39	11	5
Tanks	269	45	–
Barrels	48	14	11
Materials Heating Equipment	1,433	302	201
Heat-treating furnaces	1,042	258	114
Stock-heating furnaces	66	21	16
Salt baths	79	10	16
Induction heating units	27	2	–
Baking and drying ovens	161	8	26
Flame hardening	58	3	27
Cleaning Equipment	1,168	210	176
Tumbling barrels	488	101	109
Shot and abrasive blast	138	16	8
Parts washing machines	359	66	50
Pickling machines	85	21	6
Tanks	98	6	3
Cranes, Overhead Traveling	1,557	204	567
Hoists (Incl. Jib and Rail Mounting)	7,768	2,767	756
Chain, hand	3,629	1,459	469
Electric	3,931	1,240	234
Pneumatic	208	68	53
Industrial Trucks	1,898	280	304
Lift	1,467	212	280
Truck-tractor	121	8	8
Powered hand trucks	200	49	8
Crane	110	11	8

DETROIT and TOLEDO

959 plants, 436,430 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**122,443**	**51%**	**26%**
Metal Forming	**33,759**	**70**	**41**
Other Equip.	**44,014**	**34**	**14**
Total	**200,216**	**50**	**26**

These two marketing areas include Oakland and Wayne counties in Michigan; Lucas County in Ohio

	TOTAL	10-20 YEARS	OVER 20 YR
MACHINE TOOLS	122,443	31,221	31,845
Boring Machines	3,697	1,028	362
Horizontal boring, drilling, and milling	629	244	148
Vertical boring mills, including vertical turret lathes	492	156	66
Precision, horizontal and vertical	1,313	342	53
Jig boring, horizontal and vertical	267	69	47
Other	796	216	28
Broaching Machines	2,048	983	271
Horizontal internal	488	212	137
Horizontal surface	100	73	–
Vertical internal	334	132	63
Vertical surface	834	372	61
Other	272	194	10
Contour sawing and filing	165	15	102
Cutoff Machines	3,172	644	534
Bandsaw	1,115	231	197
Abrasive disk	357	75	44
Hacksaws	757	179	145
Rotary, hot or cold	602	84	85
Other	261	75	62
Drilling Machines	27,871	7,196	9,687
Sensitive	4,263	707	2,235
Upright: Single-spindle	7,351	1,413	2,621
Gang	6,561	2,461	3,232
Radial	1,597	368	471
Multi-spindle closer, adjustable & fixed center	1,694	509	364
Unit head and way type, multi-spindle	1,406	552	190
Deep-hole drills	142	67	5
Other	2,857	1,119	569
Gear Cutting and Finishing Machines	7,604	3,140	1,564
Hobbing machines	2,483	1,021	529
Shapers, gear	1,733	489	645
Cutters, form-milling type	85	10	52
Bevel gear cutters (not planer)	1,214	688	201
Cutters, planer type	–	–	–
Grinders, gear	203	54	5
Shavers, gear	761	249	16
Burnishing and lapping	570	325	65
Chamfering, tooth pointing, tooth rounding	466	276	35
Other	99	34	16
Gear Checking Machines	492	102	91
Grinding Machines	32,932	7,068	6,718
External cylindrical, plain and universal	5,899	1,490	1,544
Internal cylindrical	2,369	849	359
Centerless: External	2,215	720	318
Internal	221	108	16
Surface: Rotary table type	1,205	332	223
Reciprocating type	2,639	681	528
Disk, horizontal and vertical	811	280	213
Tool and cutter	7,584	1,659	2,376
Bench, floorstand, and snag	3,474	667	688
Abrasive belt (not polishing)	167	12	11
Other	6,328	670	452
Honing and Lapping	2,048	584	117
Honing	1,155	230	30
Lapping: External	167	54	23
Internal	491	188	46
Surface	235	112	18
Lathes	19,058	4,733	5,663
Bench and floor, light-duty	1,562	230	504
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	6,682	1,941	1,821
Turret lathes: Ram type and hand screw	1,928	363	598
Saddle type	483	99	127
Automatic chucking, horizontal and vertical	3,026	834	989
Automatic between centers chucking	442	118	69
Automatic screw machines, bar	3,671	773	1,160
Gun and shaft boring	4	1	1
Other	1,260	374	394
Milling Machines	9,999	2,355	3,003
Bench type	158	12	24
Hand	1,754	317	699
Knee-type, horizontal	2,165	549	780
Vertical	1,290	270	288
Automatic and manufacturing	1,459	367	382
Bed (Lincoln) type, incl automatic rise and fall	1,053	302	288
Planer type	83	27	25
Die sinkers (except engraving) & duplicators	189	48	72
Other	1,828	483	449
Planers	395	81	191
Double housing	246	46	139
Openside	125	31	47
Other	24	4	5
Pipe Cutting and Threading Machines	359	87	100
Polishing and Buffing Machines	6,549	1,463	1,429
Speed lathes	1,574	409	569
Polishing stands	3,178	641	648
Abrasive belt	583	60	22
Other	1,214	371	190
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	1,777	469	730
Horizontal	1,467	398	607
Vertical, including slotters	188	46	63
Keyseaters	122	25	60
Threading (except pipe)	2,814	704	955
Tapping	1,548	457	442
Hobbing and milling	220	50	51
Die type	472	143	188
Grinders, thread	178	8	4
Rolling machines, thread	390	44	272
Other	11	2	–
Other Machine Tools	1,463	569	329
METAL FORMING MACHINERY	33,759	9,634	14,035
Bending and Forming Machines	2,355	758	689
Bending rolls, sheet and plate	468	145	155
Bending rolls, bars and shapes	227	86	8
Power bending brakes	404	103	115
Rotary forming machines	121	27	62
Bending machines, pipe and bar	98	12	19
Other	1,037	385	330
Hydraulic Presses	1,015	357	41
Vertical, single action	652	221	40
Vertical, double and triple action	28	2	–
Horizontal	17	6	–
Other (including hydro-pneumatic)	317	128	1
Pneumatic Presses (except hydro-pneumatic)	104	13	39
Mechanical Presses, Power Driven	23,046	6,315	10,953
Inclinable	8,640	2,539	3,557
Vertical, C-frame	4,908	1,269	2,902
Vertical, straight-sided	6,572	1,761	3,199
Dieing machines	224	15	–
Horizontal	290	133	194
Other	2,412	598	1,101
Punching and Shearing Machines	2,641	904	946
Punching machines	1,189	477	431
Plate and sheet shears	974	211	393
Bar and angle shears	105	38	31
Rotary shears	62	16	33
Other	311	162	58
Forging Machinery (except presses)	1,487	344	694
Hammers, steam or air	673	151	313
Hammers, gravity drop	99	13	50
Hammers, helve	31	10	7
Forging machines (headers) and rolls	476	87	276
Other	208	83	48
Swaging Machines	126	39	40
Wire and Strip Forming Machines	425	103	131
Die Casting Machines	535	120	42
Hot chamber	356	53	36
Cold chamber	179	67	6
Plastic Molding Machines	297	149	2
Injection	76	33	1
Compression	221	116	1
Riveting Machines (Not Portable)	1,726	532	458
OTHER SHOP EQUIPMENT	44,014	8,807	6,001
Electric Welding Machines (Not Hand)	12,192	2,931	1,600
Arc: Motor-generator set	3,007	767	263
Transformer	839	234	8
Automatic and other	1,106	265	82
Resistance: Spot	3,866	1,214	916
Projection	933	215	152
Gun	467	42	26
Seam	129	40	30
Butt and flash	1,845	154	123
Gas Welding, Cutting Machines (Not Hand)	193	31	6
Flame cutting	146	21	6
Welding	47	10	–
Balancing Machines	852	266	208
Air Compressors	1,071	196	97
Plating Equipment	2,361	569	294
Machines	60	37	–
Tanks	1,987	354	275
Barrels	314	178	19
Materials Heating Equipment	5,827	1,379	1,043
Heat-treating furnaces	1,912	901	742
Stock-heating furnaces	495	139	97
Salt baths	175	20	10
Induction heating units	237	3	116
Baking and drying ovens	987	312	77
Flame hardening	21	4	1
Cleaning Equipment	6,089	1,436	810
Tumbling barrels	1,356	437	302
Shot and abrasive blast	603	136	19
Parts washing machines	1,661	264	158
Pickling machines	224	59	8
Tanks	2,245	540	323
Cranes, Overhead Traveling	2,025	326	857
Hoists (Incl. Jib and Rail Mounting)	9,772	1,296	810
Chain, hand	2,565	605	38
Electric	6,559	599	569
Pneumatic	648	90	203
Industrial Trucks	3,632	379	276
Lift	2,232	286	181
Truck-tractor	75	10	47
Powered hand trucks	612	5	43
Crane	113	18	5

MILWAUKEE

351 plants, 149,283 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**37,315**	**43%**	**22%**
Metal Forming	**7,370**	**57**	**32**
Other Equip.	**20,938**	**34**	**13**
Total	**65,623**	**42**	**20**

This marketing area includes Milwaukee, Kenosha, and Racine counties in Wisconsin

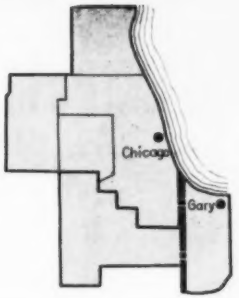
	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	37,315	7,950	7,944
Boring Machines	1,985	329	596
Horizontal boring, drilling, and milling	715	130	208
Vertical boring mills including vertical turret lathes	753	81	341
Precision, horizontal and vertical	190	28	4
Jig boring, horizontal and vertical	225	46	25
Other	102	44	18
Broaching Machines	245	53	50
Horizontal internal	139	32	42
Horizontal surface	42	–	–
Vertical internal	11	7	4
Vertical surface	46	14	–
Other	7	–	4
Contour sawing and filing	162	21	18
Cutoff Machines	1,931	345	223
Bandsaw	597	63	46
Abrasive disk	285	32	11
Hacksaws	788	208	134
Rotary, hot or cold	155	35	21
Other	106	7	11
Drilling Machines	7,611	1,756	1,567
Sensitive	1,084	141	130
Upright: Single spindle	3,052	705	715
Gang	881	290	185
Radial	1,331	316	233
Multi-spindle cluster, adjustable & fixed center	313	46	102
Unit head and way type, multi-spindle	262	194	51
Deep-hole drills	113	18	74
Other	475	46	77
Gear Cutting and Finishing Machines	1,181	334	269
Hobbing machines	542	169	102
Shapers, gear	183	42	56
Cutters, form-milling type	141	49	77
Bevel gear cutters (not planer)	66	7	11
Cutters, planer type	4	–	–
Grinders, gear	11	7	–
Shavers, gear	63	7	–
Burnishing and lapping	108	39	12
Chamfering, tooth pointing, tooth rounding	42	14	11
Other	21	–	–
Gear Checking Machines	123	24	7
Grinding Machines	7,621	1,554	1,316
External cylindrical, plain and universal	836	246	148
Internal cylindrical	275	39	39
Centerless: External	134	53	–
Internal	18	9	2
Surface: Rotary table type	436	81	35
Reciprocating type	669	144	77
Disk, horizontal and vertical	384	81	116
Tool and cutter	1,725	324	268
Bench, floor-stand, and snag	2,626	514	567
Abrasive belt (not polishing)	215	21	4
Other	303	42	60
Honing and Lapping	187	32	18
Honing	123	18	11
Lapping: External	18	14	–
Internal	11	–	–
Surface	35	–	7
Lathes	8,839	1,858	2,234
Bench and floor, light-duty[1]	1,492	310	222
Engine, heavy-duty, incl toolrm, mtg, set form, gap	2,915	620	901
Turret lathes: Ram type and hand screw	1,647	359	387
Saddle type	909	203	208
Automatic chucking, horizontal and vertical	232	70	28
Automatic between centers chucking	141	99	11
Automatic screw machines, bar	1,351	169	417
Gun and shaft boring	25	–	21
Other	127	28	39
Milling Machines	3,527	820	528
Bench type	77	32	4
Hand	491	113	70
Knee-type, horizontal	1,422	320	246
Vertical	546	70	56
Automatic and manufacturing	169	39	7
Bed (Lincoln) type, incl automatic rise and fall	266	63	42
Planer type	165	70	46
Die sinkers (except engraving) & duplicators	116	18	11
Other	275	95	46
Planers	599	120	299
Double housing	398	81	236
Openside	127	28	21
Other	74	11	42
Pipe Cutting and Threading Machines	211	67	60
Polishing and Buffing Machines	1,141	228	113
Speed lathes	373	77	46
Polishing stands	472	95	56
Abrasive belt	236	56	4
Other	60	–	7
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	1,101	215	432
Horizontal	701	165	260
Vertical, including slotters	172	18	102
Keyseaters	149	32	70
Threading (except pipe)	619	141	137
Tapping	264	63	49
Hobbing and milling	74	21	18
Die type	190	42	70
Grinders, thread	56	–	–
Rolling machines, thread	14	4	–
Other	21	11	–
Other Machine Tools	232	53	77
METAL FORMING MACHINERY	7,370	1,837	2,389
Bending and Forming Machines	872	258	212
Bending rolls, sheet and plate	341	106	113
Bending rolls, bars and shapes	102	28	18
Power bending brakes	165	56	21
Rotary forming machines	39	4	7
Bending machines, pipe and bar	102	25	18
Other	123	39	35
Hydraulic Presses	743	120	179
Vertical, single action	356	74	49
Vertical, double and triple action	204	18	70
Horizontal	84	21	32
Other (including hydro-pneumatic)	99	7	28
Pneumatic Presses (except hydro-pneumatic)	35	4	7
Mechanical Presses, Power Driven	3,646	848	1,399
Inclinable	1,373	387	155
Vertical, C-frame	524	158	225
Vertical, straight-sided	1,376	211	843
Dieing machines	21	–	14
Horizontal	18	4	14
Other	334	88	148
Punching and Shearing Machines	1,038	237	412
Punching machines	232	56	95
Plate and sheet shears	387	120	120
Bar and angle shears	106	4	49
Rotary shears	116	25	46
Other	197	32	102
Forging Machinery (except presses)	239	50	110
Hammers, steam or air	116	28	60
Hammers, gravity drop	49	7	11
Hammers, helve	14	4	11
Forging machines (headers) and rolls	49	11	21
Other	11	–	7
Swaging Machines	46	7	–
Wire and Strip Forming Machines	14	–	–
Die Casting Machines	4	–	–
Hot chamber	4	–	–
Cold chamber	–	–	–
Plastic Molding Machines	78	7	–
Injection	60	–	–
Compression	18	7	–
Riveting Machines (Not Portable)	655	306	70
OTHER SHOP EQUIPMENT	20,938	4,349	2,658
Electric Welding Machines (Not Hand)	4,717	1,014	142
Arc: Motor-generator set	2,246	658	102
Transformer	1,380	81	–
Automatic and other	116	14	4
Resistance: Spot	556	112	14
Projection	113	46	4
Gun	137	11	–
Seam	56	46	–
Butt and flash	133	46	18
Gas Welding, Cutting Machines (Not Hand)	401	53	4
Flame cutting	345	49	4
Welding	56	4	–
Balancing Machines	253	39	49
Air Compressors	803	137	77
Plating Equipment	698	102	43
Machines	70	7	4
Tanks	494	74	32
Barrels	134	21	7
Materials Heating Equipment	2,129	473	401
Heat-treating furnaces	1,007	218	144
Stock-heating furnaces	436	106	158
Salt baths	56	11	4
Induction heating units	116	14	14
Baking and drying ovens	468	106	77
Flame hardening	46	18	4
Cleaning Equipment	1,097	208	134
Tumbling barrels	226	42	21
Shot and abrasive blast	334	81	35
Parts washing machines	137	32	11
Pickling machines	49	4	4
Tanks	341	49	63
Cranes, Overhead Traveling	2,307	275	1,320
Hoists (Incl. Jib and Rail Mounting)	6,264	1,807	355
Chain, hand	1,978	774	170
Electric	3,343	758	170
Pneumatic	743	275	15
Industrial Trucks	2,269	241	133
Lift	1,502	151	101
Truck-tractor	372	39	12
Powered hand trucks	302	39	20
Crane	93	12	–

CHICAGO

1659 plants, 407,506 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**120,437**	**40%**	**15%**
Metal Forming	**42,871**	**54**	**23**
Other Equip.	**61,655**	**32**	**8**
Total	**224,963**	**41**	**15**

This marketing area includes Cook, Du Page, Kane, Lake, and Will counties in Illinois; and Lake County in Indiana



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	120,437	30,296	18,132
Boring Machines	2,539	687	314
Horizontal boring, drilling, and milling	1,047	337	96
Vertical boring mills including vertical turret lathes	723	193	167
Precision, horizontal and vertical	219	32	–
Jig boring, horizontal and vertical	344	85	6
Other	206	40	45
Broaching Machines	491	143	96
Horizontal internal	202	37	61
Horizontal surface	32	18	–
Vertical internal	96	32	–
Vertical surface	135	46	13
Other	26	10	22
Contour sawing and filing	662	121	77
Cutoff Machines	6,344	1,433	759
Bandsaw	2,532	531	180
Abrasive disk	791	84	6
Hacksaws	2,170	624	319
Rotary, hot or cold	318	72	45
Other	533	122	209
Drilling Machines	27,585	6,382	3,706
Sensitive	3,607	896	193
Upright: Single-spindle	12,910	3,021	1,577
Gang	5,510	1,115	1,152
Radial	2,189	649	354
Multi-spindle classes, adjustable & fixed center	727	231	77
Unit head and way type, multi-spindle	440	129	51
Deep-hole drills	72	45	–
Other	2,130	296	302
Gear Cutting and Finishing Machines	2,090	413	380
Hobbing machines	900	219	244
Shapers, gear	276	58	26
Cutters, form-milling type	699	66	71
Bevel gear cutters (not planer)	71	26	13
Cutters, planer type	13	–	13
Grinders, gear	41	6	–
Shavers, gear	6	–	–
Burnishing and lapping	45	32	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	39	6	13
Gear Checking Machines	304	69	13
Grinding Machines	21,394	5,465	2,381
External cylindrical, plain and universal	2,529	604	347
Internal cylindrical	794	149	109
Centerless: External	557	58	19
Internal	39	10	–
Surface: Rotary table type	874	212	141
Reciprocating type	3,112	819	174
Disk, horizontal and vertical	926	302	180
Tool and cutter	3,707	729	373
Bench, floorstand, and snag	6,181	2,122	743
Abrasive belt (not polishing)	1,162	203	64
Other	1,513	257	231
Honing and Lapping	1,598	193	26
Honing	413	77	–
Lapping: External	274	67	13
Internal	570	13	–
Surface	341	36	13
Lathes	30,043	8,336	5,249
Bench and floor, light-duty	6,947	1,859	1,197
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	7,999	2,585	1,434
Turret lathes: Ram type and hand screw	6,214	1,305	1,068
Saddle type	964	382	51
Automatic chucking, horizontal and vertical	524	71	64
Automatic between centers chucking	203	32	–
Automatic screw machines, bar	6,669	1,853	1,297
Gun and shaft boring	84	18	6
Other	439	231	132
Milling Machines	12,298	3,404	1,815
Bench type	904	180	204
Hand	1,541	485	491
Knee-type, horizontal	4,604	1,518	733
Vertical	2,151	585	71
Automatic and manufacturing	1,100	206	71
Bed (Lincoln) type, incl automatic rise and fall	614	71	26
Planer type	226	55	109
Die sinkers (except engraving) & duplicators	473	143	46
Other	685	161	64
Planers	944	258	540
Double housing	527	161	293
Openside	245	39	174
Other	172	58	73
Pipe Cutting and Threading Machines	780	251	64
Polishing and Buffing Machines	5,612	1,119	494
Speed lathes	1,676	302	130
Polishing stands	2,639	727	293
Abrasive belt	1,017	71	26
Other	280	19	45
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	2,947	1,090	800
Horizontal	2,352	801	627
Vertical, including slotters	344	186	77
Keyseaters	251	103	96
Threading (except pipe)	4,349	816	1,283
Tapping	2,075	463	341
Hobbing and milling	403	60	180
Die type	402	58	58
Grinders, thread	254	6	–
Rolling machines, thread	573	216	203
Other	642	13	501
Other Machine Tools	457	116	135
METAL FORMING MACHINERY	42,871	13,752	10,040
Bending and Forming Machines	5,336	1,874	677
Bending rolls, sheet and plate	1,037	267	235
Bending rolls, bars and shapes	412	86	111
Power bending brakes	1,557	463	109
Rotary forming machines	820	302	64
Bending machines, pipe and bar	392	109	19
Other	1,118	547	139
Hydraulic Presses	2,225	368	115
Vertical, single action	1,376	215	109
Vertical, double and triple action	154	26	–
Horizontal	219	77	6
Other (including hydro-pneumatic)	276	50	–
Pneumatic Presses (except hydro-pneumatic)	251	40	–
Mechanical Presses, Power Driven	21,518	7,730	5,309
Inclinable	11,855	4,009	2,800
Vertical, C-frame	2,349	1,052	650
Vertical, straight-sided	4,685	1,692	1,107
Dieing machines	186	64	19
Horizontal	154	77	32
Other	2,289	836	701
Punching and Shearing Machines	5,238	1,639	1,607
Punching machines	1,885	662	907
Plate and sheet shears	1,988	553	405
Bar and angle shears	471	129	109
Rotary shears	338	166	64
Other	556	129	122
Forging Machinery (except presses)	2,075	272	1,205
Hammers, steam or air	512	102	325
Hammers, gravity drop	370	64	284
Hammers, helve	184	68	91
Forging machines (headers) and rolls	847	32	441
Other	162	6	64
Swaging Machines	370	135	139
Wire and Strip Forming Machines	902	429	303
Die Casting Machines	557	19	–
Hot chamber	251	19	–
Cold chamber	306	–	–
Plastic Molding Machines	229	52	–
Injection	139	26	–
Compression	90	26	–
Riveting Machines (Not Portable)	4,170	694	685
OTHER SHOP EQUIPMENT	61,655	14,968	5,167
Electric Welding Machines (Not Hand)	16,650	3,625	366
Arc: Motor-generator set	8,073	1,710	90
Transformer	3,440	228	6
Automatic and other	740	51	–
Resistance: Spot	3,894	1,310	257
Projection	424	139	–
Gun	572	59	–
Seam	169	64	13
Butt and flash	338	64	–
Gas Welding, Cutting Machines (Not Hand)	1,036	274	–
Flame cutting	692	167	–
Welding	344	107	–
Balancing Machines	286	109	19
Air Compressors	3,032	811	486
Plating Equipment	4,394	814	158
Machines	229	19	13
Tanks	3,315	546	132
Barrels	850	249	13
Materials Heating Equipment	7,958	2,226	1,044
Heat-treating furnaces	4,281	1,435	550
Stock-heating furnaces	1,439	270	392
Salt baths	409	64	19
Induction heating units	338	–	–
Baking and drying ovens	1,427	444	77
Flame hardening	64	13	6
Cleaning Equipment	6,311	1,695	545
Tumbling barrels	2,792	647	425
Shot and abrasive blast	901	167	22
Parts washing machines	984	226	19
Pickling machines	136	50	–
Tanks	1,498	605	69
Cranes, Overhead Traveling	2,212	437	675
Hoists (Incl. Jib and Rail Mounting)	11,925	3,442	1,591
Chain, hand	6,801	1,936	880
Electric	4,633	1,297	698
Pneumatic	491	209	13
Industrial Trucks	7,851	1,535	283
Lift	4,372	862	148
Truck-tractor	534	122	25
Powered hand trucks	2,443	397	6
Crane	502	154	103

INDIANAPOLIS

148 plants, 54,604 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**11,580**	**34%**	**4%**
Metal Forming	**2,539**	**51**	**20**
Other Equip.	**7,777**	**32**	**2**
Total	**21,896**	**35**	**5**

This marketing area includes Marion County, Indiana

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	11,580	3,473	420
Boring Machines	498	102	12
Horizontal boring, drilling, and milling	76	31	2
Vertical boring mills including vertical turret lathes	76	28	8
Precision, horizontal and vertical	230	34	–
Jig boring, horizontal and vertical	39	6	2
Other	55	3	–
Broaching Machines	135	47	2
Horizontal internal	55	25	2
Horizontal surface	–	–	–
Vertical internal	5	–	–
Vertical surface	73	20	–
Other	2	2	–
Contour sawing and filing	50	16	3
Cutoff Machines	365	107	13
Bandsaw	124	35	5
Abrasive disk	86	31	–
Hacksaws	131	47	6
Rotary, hot or cold	28	17	2
Other	6	2	–
Drilling Machines	2,261	706	142
Sensitive	362	120	5
Upright: Single spindle	507	133	20
Gang	763	276	95
Radial	104	66	6
Multi-spindle cluster, adjustable & fixed center	153	44	8
Unit head and way type, multi-spindle	48	20	3
Deep-hole drills	43	8	3
Other	203	47	2
Gear Cutting and Finishing Machines	725	284	4
Hobbing machines	287	119	2
Shapers, gear	186	83	2
Cutters, form-milling type	2	2	–
Bevel gear cutters (not planer)	47	4	–
Cutters, planer type	14	2	–
Grinders, gear	69	8	–
Shavers, gear	59	25	–
Burnishing and lapping	44	14	–
Chamfering, tooth pointing, tooth rounding	47	21	–
Other	–	–	–
Gear Checking Machines	14	8	–
Grinding Machines	2,614	774	59
External cylindrical, plain and universal	429	120	5
Internal cylindrical	243	44	6
Centerless: External	119	31	2
Internal	5	–	–
Surface: Rotary table type	137	39	2
Reciprocating type	220	59	6
Disk, horizontal and vertical	61	14	3
Tool and cutter	905	265	20
Bench, floor-stand, snag	355	154	8
Abrasive belt (not polishing)	44	5	–
Other	115	20	6
Honing and Lapping	94	17	5
Honing	41	11	–
Lapping: External	39	3	3
Internal	2	–	2
Surface	12	3	–
Lathes	2,666	803	93
Bench and floor, light-duty	722	92	17
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	955	356	37
Turret lathes: Ram type and hand screw	563	179	3
Saddle type	62	14	–
Automatic chucking, horizontal and vertical	125	48	3
Automatic between-centers chucking	9	6	–
Automatic screw machines, bar	146	101	3
Gun and shaft boring	5	2	–
Other	79	5	–
Milling Machines	1,071	324	46
Bench type	42	14	–
Hand	156	45	12
Knee-type, horizontal	318	114	19
Vertical	223	53	3
Automatic and manufacturing	120	23	5
Bed (Lincoln) type, incl automatic rise and fall	117	30	3
Planer type	19	5	–
Die sinkers (except engraving) & duplicators	20	9	–
Other	91	28	2
Planers	43	11	5
Double housing	21	5	3
Openside	16	5	2
Other	6	–	–
Pipe Cutting and Threading Machines	58	22	3
Polishing and Buffing Machines	511	95	15
Speed lathes	126	31	3
Polishing stands	237	42	9
Abrasive belt	69	16	3
Other	79	6	–
Rifle Working Machines (not deep-hole drills)			
Shapers	169	68	11
Horizontal	147	55	5
Vertical, including slotters	22	13	3
Keyseaters	9	2	–
Threading (except pipe)	288	89	7
Tapping	178	56	3
Hobbing and milling	82	16	2
Die type	14	8	–
Grinders, thread	41	9	–
Rolling machines, thread	8	–	2
Other	5	–	–
Other Machine Tools	–	–	–
METAL FORMING MACHINERY	2,539	792	507
Bending and Forming Machines	318	97	46
Bending rolls, sheet and plate	87	31	14
Bending rolls, bars and shapes	36	3	3
Power bending brakes	67	20	11
Rotary forming machines	17	3	6
Bending machines, pipe and bar	38	12	6
Other	93	31	6
Hydraulic Presses	125	49	–
Vertical, single action	97	41	–
Vertical, double and triple action	12	3	–
Horizontal	3	2	–
Other (including hydro-pneumatic)	11	3	–
Pneumatic Presses (except hydro-pneumatic)	25	9	2
Mechanical Presses, Power Driven	1,401	437	360
Inclinable	596	193	122
Vertical, C-frame	289	51	128
Vertical, straight-side	424	175	106
Dieing machines	3	2	–
Horizontal	6	5	2
Other	83	11	–
Punching and Shearing Machines	322	102	87
Punching machines	142	41	62
Plate and sheet shears	142	45	17
Bar and angle shears	12	3	6
Rotary shears	17	8	2
Other	9	5	–
Forging Machinery (except presses)	89	33	6
Hammers, steam or air	25	11	6
Hammers, gravity drop	20	6	–
Hammers, helve	11	5	–
Forging machines (headers) and rolls	–	–	–
Other	33	11	–
Swaging Machines	3	3	–
Wire and Strip Forming Machines	37	9	–
Die Casting Machines	19	5	–
Hot chamber	14	5	–
Cold chamber	5	–	–
Plastic Molding Machines	2	–	–
Injection	–	–	–
Compression	2	–	–
Riveting Machines (Not Portable)	198	48	6
OTHER SHOP EQUIPMENT	7,777	2,330	122
Electric Welding Machines (Not Hand)	774	211	19
Arc: Motor-generator set	239	81	5
Transformer	36	8	–
Automatic and other	76	11	–
Resistance: Spot	332	89	12
Projection	50	14	–
Gun	2	–	–
Seam	8	–	–
Butt and flash	31	8	2
Gas Welding, Cutting Machines (Not Hand)	37	5	–
Flame cutting	28	5	–
Welding	9	–	–
Balancing Machines	5	2	–
Air Compressors	64	11	9
Plating Equipment	192	14	–
Machines	47	2	–
Tanks	126	12	–
Barrels	19	–	–
Materials Heating Equipment	715	183	30
Heat-treating furnaces	387	139	16
Stock-heating furnaces	44	11	2
Salt baths	14	3	–
Induction heating units	2	–	–
Baking and drying ovens	75	30	12
Flame hardening	–	–	–
Cleaning Equipment	355	80	5
Tumbling barrels	94	11	2
Shot and abrasive blast	70	9	–
Parts washing machines	150	51	3
Pickling machines	33	9	–
Tanks	6	–	–
Cranes, Overhead Traveling	58	–	25
Hoists (Incl. Jib and Rail Mounting)	2,576	723	34
Chain, hand	1,504	490	17
Electric	1,055	233	17
Pneumatic	17	–	–
Industrial Trucks	3,001	1,101	–
Lift	1,064	266	–
Truck-tractor	75	33	–
Powered hand trucks	1,521	652	–
Crane	341	150	–

MIDWESTERN STATES

2730 plants, 896,028 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**273,829**	**43%**	**23%**
Metal Forming	**78,479**	**37**	**28**
Other Equip.	**160,517**	**33**	**12**
Total	**512,825**	**42**	**20**

This area includes Ohio, Michigan, Indiana, Illinois, and Wisconsin except counties covered in other tables

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	273,829	56,961	62,533
Boring Machines	9,362	1,900	1,876
Horizontal boring, drilling, and milling	3,377	808	598
Vertical boring mills including vertical turret lathes	3,080	597	1,041
Precision, horizontal and vertical	1,432	218	18
Jig boring, horizontal and vertical	860	152	93
Other	613	125	126
Broaching Machines	2,354	633	353
Horizontal internal	961	274	206
Horizontal surface	247	45	26
Vertical internal	674	165	86
Vertical surface	345	88	9
Other	127	61	26
Contour sawing and filing	952	157	158
Cutoff Machines	12,036	2,658	2,141
Bandsaw	4,444	794	533
Abrasive disk	1,339	337	122
Hacksaws	4,214	1,066	894
Rotary, hot or cold	848	115	246
Other	1,091	346	346
Drilling Machines	64,326	12,608	13,582
Sensitive	10,251	1,505	1,577
Upright: Single-spindle	30,411	6,114	6,823
Gang	7,197	1,593	1,441
Radial	7,661	1,488	1,867
Multi-spindle cluster, adjustable & fixed center	3,830	1,111	903
Unit head and way type, multi-spindle	2,037	302	414
Deep-hole drills	378	40	85
Other	2,561	455	472
Gear Cutting and Finishing Machines	7,313	1,865	1,769
Hobbing machines	3,077	842	742
Shapers, gear	1,417	374	321
Cutters, form-milling type	516	155	234
Bevel gear cutters (not planer)	978	220	329
Cutters, planer type	181	34	61
Grinders, gear	121	21	22
Shavers, gear	305	49	9
Burnishing and lapping	267	92	12
Chamfering, tooth pointing, tooth rounding	264	65	21
Other	187	13	18
Gear Checking Machines	614	119	103
Grinding Machines	55,849	11,614	10,357
External cylindrical, plain and universal	6,910	1,177	1,403
Internal cylindrical	2,639	523	285
Centerless: External	1,788	535	121
Internal	72	29	4
Surface: Rotary table type	2,369	557	281
Reciprocating type	5,699	1,320	848
Disk, horizontal and vertical	1,979	666	433
Tool and cutter	9,414	1,328	2,097
Bench, floorstand, and snag	19,658	4,401	4,114
Abrasive belt (not polishing)	2,294	437	198
Other	3,027	641	573
Honing and Lapping	2,178	617	124
Honing	1,156	369	41
Lapping: External	367	92	36
Internal	341	53	43
Surface	314	103	4
Lathes	57,555	12,325	14,725
Bench and floor, light-duty	7,707	1,619	1,735
Engine, heavy-duty, incl toolrm, mfg, nut form, gap	18,824	4,064	6,799
Turret lathes: Ram type and hand screw	10,640	2,313	2,416
Saddle type	5,313	1,057	906
Automatic chucking, horizontal and vertical	3,604	718	312
Automatic between centers chucking	1,133	223	160
Automatic screw machines, bar	8,080	1,820	1,312
Gun and shaft boring	161	30	78
Other	2,073	481	1,007
Milling Machines	26,508	4,259	6,141
Bench type	697	214	171
Hand	3,527	831	599
Knee-type, horizontal	8,946	1,422	2,599
Vertical	5,467	778	732
Automatic and manufacturing	3,762	435	551
Bed (Lincoln) type, incl automatic rise and fall	1,559	131	260
Planer type	703	113	244
Die sinkers (except engraving) & duplicators	585	148	165
Other	1,262	187	420
Planers	3,145	639	1,812
Double housing	2,035	398	1,289
Openside	752	141	351
Other	358	100	172
Pipe Cutting and Threading Machines	2,006	287	519
Polishing and Buffing Machines	11,197	2,446	2,621
Speed lathes	2,590	697	661
Polishing stands	5,871	1,287	1,357
Abrasive belt	1,461	364	280
Other	1,275	98	323
Rifle Working Machines (not deep-hole drills)	182	–	–
Shapers	6,833	1,768	2,395
Horizontal	5,046	1,395	1,731
Vertical, including slotters	1,082	205	508
Keyseaters	705	168	356
Threading (except pipe)	8,897	2,390	3,248
Tapping	3,320	771	808
Hobbing and milling	895	146	142
Die type	858	356	297
Grinders, thread	304	34	9
Rolling machines, thread	3,073	364	176
Other	2,447	719	1,816
Other Machine Tools	2,522	676	609
METAL FORMING MACHINERY	78,479	22,969	21,687
Bending and Forming Machines	8,421	2,778	1,976
Bending rolls, sheet and plate	2,215	599	571
Bending rolls, bars and shapes	510	127	164
Power bending brakes	2,600	911	361
Rotary forming machines	1,222	418	459
Bending machines, pipe and bar	952	268	191
Other	922	455	230
Hydraulic Presses	5,476	772	753
Vertical, single action	3,907	533	366
Vertical, double and triple action	534	88	104
Horizontal	699	106	261
Other (including hydro-pneumatic)	336	45	22
Pneumatic Presses (except hydro-pneumatic)	1,107	85	68
Mechanical Presses, Power Driven	39,604	12,407	11,170
Inclinable	19,379	6,440	4,021
Vertical, C-frame	4,376	1,625	1,671
Vertical, straight-sided	9,384	2,207	3,755
Dieing machines	757	388	77
Horizontal	731	279	235
Other	4,977	1,468	1,411
Punching and Shearing Machines	9,282	2,667	3,498
Punching machines	2,390	618	1,357
Plate and sheet shears	3,679	1,145	1,126
Bar and angle shears	1,084	393	552
Rotary shears	871	302	320
Other	758	209	143
Forging Machinery (except presses)	4,296	1,247	2,258
Hammers, steam or air	640	62	427
Hammers, gravity drop	1,225	309	802
Hammers, helve	693	270	351
Forging machines (headers) and rolls	1,534	514	527
Other	204	92	151
Swaging Machines	740	293	239
Wire and Strip Forming Machines	2,774	945	984
Die Cutting Machines	856	203	68
Hot chamber	484	131	59
Cold chamber	372	72	9
Plastic Molding Machines	887	404	–
Injection	348	44	–
Compression	539	360	–
Riveting Machines (Not Portable)	5,036	1,168	673
OTHER SHOP EQUIPMENT	160,517	34,391	18,581
Electric Welding Machines (Not Hand)	26,895	6,135	1,611
Arc: Motor-generator set	10,170	2,247	412
Transformer	4,405	373	115
Automatic and other	1,065	125	13
Resistance: Spot	7,705	2,265	902
Projection	875	432	21
Gun	1,131	299	9
Seam	448	74	–
Butt and flash	1,096	320	139
Gas Welding, Cutting Machines (Not Hand)	2,820	511	45
Flame cutting	1,780	277	20
Welding	1,040	234	25
Balancing Machines	904	271	69
Air Compressors	7,612	1,935	918
Plating Equipment	5,427	1,620	513
Machines	480	160	160
Tanks	3,469	996	145
Barrels	1,478	464	208
Materials Heating Equipment	18,003	5,040	3,363
Heat-treating furnaces	8,645	2,283	1,410
Stock-heating furnaces	4,274	1,621	1,254
Salt baths	1,147	349	151
Induction heating units	940	17	9
Baking and drying ovens	2,558	584	499
Flame hardening	439	86	40
Cleaning Equipment	13,304	3,161	1,566
Tumbling barrels	4,367	1,526	1,054
Shot and abrasive blast	2,228	368	204
Parts washing machines	1,757	210	111
Pickling machines	162	36	4
Tanks	4,790	1,021	193
Cranes, Overhead Traveling	6,555	1,175	2,478
Hoists (Incl. Jib and Rail Mounting)	59,605	11,656	7,055
Chain, hand	24,836	5,115	4,096
Electric	24,972	3,628	1,693
Pneumatic	9,797	2,913	1,266
Industrial Trucks	19,392	2,887	963
Lift	12,028	2,264	445
Truck-tractor	3,005	290	246
Powered hand trucks	2,805	255	22
Crane	1,554	78	250

MINNEAPOLIS—ST. PAUL

249 plants, 45,655 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**11,883**	**33%**	**13%**
Metal Forming	**4,333**	**35**	**15**
Other Equip.	**6,823**	**23**	**3**
Total	**23,039**	**31**	**11**

This marketing area includes Dakota, Hennepin, and Ramsey counties in Minnesota

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	11,883	2,433	1,514
Boring Machines	262	86	23
Horizontal boring, drilling, and milling	89	41	7
Vertical boring mills including vertical turret lathes	90	27	14
Precision, horizontal and vertical	25	7	–
Jig boring, horizontal and vertical	56	11	–
Other	2	–	2
Broaching Machines	63	23	11
Horizontal internal	39	16	9
Horizontal surface	11	2	–
Vertical internal	11	5	2
Vertical surface	–	–	–
Other	2	–	–
Contour sawing and filing	86	9	–
Cutoff Machines	468	91	39
Bandsaw	148	18	7
Abrasive disk	31	7	5
Hacksaws	218	64	27
Rotary, hot or cold	14	–	–
Other	57	2	–
Drilling Machines	2,719	627	392
Sensitive	231	30	–
Upright: Single-spindle	1,788	420	293
Gang	161	32	45
Radial	253	95	36
Multi-spindle cluster, adjustable & fixed center	68	23	5
Unit head and way type, multi-spindle	154	25	2
Deep-hole drills	9	–	–
Other	57	2	11
Gear Cutting and Finishing Machines	356	100	57
Hobbing machines	129	32	18
Shapers, gear	77	32	7
Cutters, form-milling type	30	9	18
Bevel gear cutters (not planer)	64	18	7
Cutters, planer type	2	–	2
Grinders, gear	11	5	–
Shavers, gear	9	–	–
Burnishing and lapping	9	–	–
Chamfering, tooth pointing, tooth rounding	16	2	5
Other	9	2	–
Gear Checking Machines	54	16	2
Grinding Machines	2,683	634	397
External cylindrical, plain and universal	186	59	16
Internal cylindrical	95	25	5
Centerless: External	56	2	2
Internal	8	–	–
Surface: Rotary table type	93	14	9
Reciprocating type	149	34	11
Disk, horizontal and vertical	90	25	11
Tool and cutter	315	57	16
Bench, floorstand, and snag	1,409	334	325
Abrasive belt (not polishing)	178	50	2
Other	104	14	–
Honing and Lapping	86	9	–
Honing	63	9	–
Lapping: External	2	–	–
Internal	7	–	–
Surface	14	–	–
Lathes	3,142	399	306
Bench and floor, light-duty	571	95	18
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	722	129	188
Turret lathes: Ram type and hand screw	488	64	61
Saddle type	86	27	9
Automatic chucking, horizontal and vertical	57	11	11
Automatic between centers chucking	14	–	5
Automatic screw machines, bar	742	73	7
Gun and shaft boring	–	–	–
Other	462	–	7
Milling Machines	903	188	127
Bench type	15	7	–
Hand	151	43	34
Knee-type, horizontal	309	77	45
Vertical	220	25	18
Automatic and manufacturing	82	9	2
Bed (Lincoln) type, incl automatic rise and fall	5	–	–
Planer type	73	18	23
Die sinkers (except engraving) & duplicators	34	7	–
Other	14	2	5
Planers	69	18	32
Double housing	44	9	27
Openside	14	–	5
Other	11	9	–
Pipe Cutting and Threading Machines	85	11	18
Polishing and Buffing Machines	331	39	7
Speed lathes	176	23	5
Polishing stands	100	14	–
Abrasive belt	50	2	–
Other	5	–	2
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	264	93	53
Horizontal	155	57	14
Vertical, including slotters	62	16	23
Keyseaters	47	20	16
Threading (except pipe)	219	60	27
Tapping	157	48	14
Hobbing and milling	9	5	–
Die type	14	5	2
Grinders, thread	9	–	–
Rolling machines, thread	23	2	9
Other	7	–	2
Other Machine Tools	93	30	23
METAL FORMING MACHINERY	4,333	857	656
Bending and Forming Machines	448	87	130
Bending rolls, sheet and plate	157	32	30
Bending rolls, bars and shapes	41	5	16
Power bending brakes	138	14	61
Rotary forming machines	57	25	7
Bending machines, pipe and bar	41	11	11
Other	14	–	5
Hydraulic Presses	134	29	11
Vertical, single action	98	20	9
Vertical, double and triple action	2	–	–
Horizontal	14	9	2
Other (including hydro-pneumatic)	20	–	–
Pneumatic Presses (except hydro-pneumatic)	110	15	–
Mechanical Presses, Power Driven	2,358	485	164
Inclinable	858	245	66
Vertical, C-frame	870	186	70
Vertical, straight-sided	420	45	7
Dieing machines	25	2	5
Horizontal	146	5	–
Other	39	2	16
Punching and Shearing Machines	611	105	239
Punching machines	333	32	191
Plate and sheet shears	183	39	36
Bar and angle shears	39	11	5
Rotary shears	45	18	7
Other	11	5	–
Forging Machinery (except presses)	177	6	98
Hammers, steam or air	36	–	25
Hammers, gravity drop	57	2	43
Hammers, helve	5	2	–
Forging machines (headers) and rolls	14	–	5
Other	65	2	25
Swaging Machines	14	7	7
Wire and Strip Forming Machines	5	2	–
Die Casting Machines	7	–	–
Hot chamber	5	–	–
Cold chamber	2	–	–
Plastic Molding Machines	174	35	–
Injection	47	12	–
Compression	127	23	–
Riveting Machines (Not Portable)	295	86	7
OTHER SHOP EQUIPMENT	6,823	1,348	249
Electric Welding Machines (Not Hand)	1,212	140	21
Arc: Motor-generator set	575	70	11
Transformer	126	20	–
Automatic and other	14	–	–
Resistance: Spot	272	39	5
Projection	14	–	–
Gun	161	–	–
Seam	14	2	5
Butt and flash	36	9	–
Gas Welding, Cutting Machines (Not Hand)	118	16	–
Flame cutting	57	7	–
Welding	61	9	–
Balancing Machines	24	–	–
Air Compressors	272	59	9
Plating Equipment	289	84	5
Machines	34	2	–
Tanks	132	34	5
Barrels	123	48	–
Materials Heating Equipment	806	240	55
Heat-treating furnaces	203	66	5
Stock-heating furnaces	119	25	45
Salt baths	30	9	–
Induction heating units	47	2	–
Baking and drying ovens	321	138	5
Flame hardening	86	–	–
Cleaning Equipment	668	130	2
Tumbling barrels	217	14	2
Shot and abrasive blast	38	9	–
Parts washing machines	123	9	–
Pickling machines	9	–	–
Tanks	281	98	–
Cranes, Overhead Traveling	163	16	66
Hoists (Incl. Jib and Rail Mounting)	1,830	322	18
Chain, hand	424	145	–
Electric	1,127	166	18
Pneumatic	269	11	–
Industrial Trucks	1,441	341	173
Lift	1,131	325	173
Truck-tractor	41	7	–
Powered hand trucks	232	2	–
Crane	37	7	–

ST. LOUIS AND KANSAS CITY

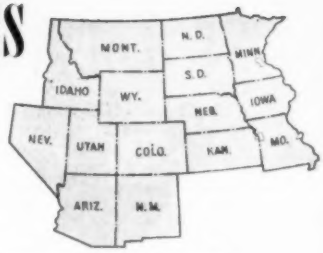
473 plants, 118,238 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**36,257**	**51%**	**29%**
Metal Forming	**18,753**	**63**	**33**
Other Equip.	**17,362**	**39**	**14**
Total	**72,372**	**50**	**26**

These two marketing areas include Madison and St. Clair counties in Illinois; St. Louis City, St. Louis, Clay, and Jackson counties in Missouri; and Wyandotte County in Kansas

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	36,257	7,812	9,317
Boring Machines	902	187	176
Horizontal boring, drilling, and milling	186	37	33
Vertical boring mills including vertical turret lathes	307	37	99
Precision, horizontal and vertical	219	66	7
Jig boring, horizontal and vertical	153	29	26
Other	37	18	11
Broaching Machines	420	180	30
Horizontal internal	99	29	22
Horizontal surface	62	56	–
Vertical internal	18	11	4
Vertical surface	241	84	4
Other	–	–	–
Contour sawing and filing	117	15	11
Cutoff Machines	1,810	223	189
Bandsaw	470	77	47
Abrasive disk	100	4	7
Hacksaws	421	120	91
Rotary, hot or cold	58	18	26
Other	761	4	18
Drilling Machines	8,832	1,585	3,107
Sensitive	1,059	150	577
Upright: Single-spindle	2,990	394	759
Gang	2,515	504	1,195
Radial	351	69	73
Multi-spindle cluster, adjustable & fixed center	486	142	77
Unit head and way type, multi-spindle	1,014	235	254
Deep-hole drills	37	–	–
Other	380	91	172
Gear Cutting and Finishing Machines	445	120	147
Hobbing machines	274	102	62
Shapers, gear	113	7	66
Cutters, form-milling type	7	–	7
Bevel gear cutters (not planer)	11	–	4
Cutters, planer type	7	–	–
Grinders, gear	4	–	–
Shavers, gear	7	–	–
Burnishing and lapping	4	–	–
Chamfering, tooth pointing, tooth rounding	7	4	4
Other	11	7	4
Gear Checking Machines	15	–	–
Grinding Machines	6,059	1,471	1,379
External cylindrical, plain and universal	686	88	245
Internal cylindrical	237	55	55
Centerless: External	360	66	84
Internal	–	–	–
Surface: Rotary table type	170	14	22
Reciprocating type	798	186	150
Disk, horizontal and vertical	270	95	58
Tool and cutter	1,757	427	438
Bench, floorstand, and snag	1,358	496	259
Abrasive belt (not polishing)	164	7	–
Other	259	37	69
Honing and Lapping	184	26	4
Honing	110	22	–
Lapping: External	15	–	–
Internal	48	4	4
Surface	11	–	–
Lathes	9,548	1,943	2,760
Bench and floor, light-duty	1,023	175	182
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	2,930	486	1,299
Turret lathes: Ram type and hand screw	1,015	153	336
Saddle type	421	33	117
Automatic chucking, horizontal and vertical	641	156	172
Automatic between centers chucking	62	–	7
Automatic screw machines, bar	3,306	896	578
Gun and shaft boring	–	–	–
Other	150	44	69
Milling Machines	2,700	434	1,063
Bench type	62	14	14
Hand	592	109	329
Knee-type, horizontal	880	150	453
Vertical	366	25	84
Automatic and manufacturing	434	66	109
Bed (Lincoln) type, incl automatic rise and fall	139	22	26
Planer type	18	7	11
Die sinkers (except engraving) & duplicators	66	4	–
Other	123	37	37
Planers	246	39	145
Double housing	173	25	109
Openside	51	14	14
Other	22	–	22
Pipe Cutting and Threading Machines	223	55	55
Polishing and Buffing Machines	2,538	920	815
Speed lathes	248	11	99
Polishing stands	2,059	854	212
Abrasive belt	183	26	4
Other	48	29	–
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	806	157	289
Horizontal	612	124	212
Vertical, including slotters	143	18	51
Keyseaters	51	15	26
Threading (except pipe)	1,222	399	347
Tapping	982	318	266
Hobbing and milling	40	–	26
Die type	47	4	22
Grinders, thread	18	–	–
Rolling machines, thread	88	55	22
Other	47	22	11
Other Machine Tools	190	58	47
METAL FORMING MACHINERY	18,753	5,590	6,166
Bending and Forming Machines	1,271	337	267
Bending rolls, sheet and plate	259	54	142
Bending rolls, bars and shapes	37	15	11
Power bending brakes	384	88	44
Rotary forming machines	85	18	4
Bending machines, pipe and bar	172	53	40
Other	233	77	26
Hydraulic Presses	849	127	249
Vertical, single action	748	114	113
Vertical, double and triple action	15	4	4
Horizontal	22	–	15
Other (including hydro-pneumatic)	66	–	40
Pneumatic Presses (except hydro-pneumatic)	157	10	46
Mechanical Presses, Power Driven	10,640	2,961	4,155
Inclinable	5,282	1,194	2,424
Vertical, C-frame	2,029	777	694
Vertical, straight-sided	1,920	464	689
Dieing machines	11	–	4
Horizontal	95	26	51
Other	1,303	500	274
Punching and Shearing Machines	2,066	569	936
Punching machines	1,240	380	639
Plate and sheet shears	620	142	230
Bar and angle shears	73	11	29
Rotary shears	100	29	51
Other	33	7	7
Forging Machinery (except presses)	295	69	128
Hammers, steam or air	152	22	88
Hammers, gravity drop	26	7	11
Hammers, helve	18	18	–
Forging machines (headers) and rolls	73	15	18
Other	26	7	11
Swaging Machines	379	15	33
Wire and Strip Forming Machines	120	73	–
Die Casting Machines	424	121	36
Hot chamber	314	77	26
Cold chamber	110	44	10
Plastic Molding Machines	336	84	62
Injection	7	–	–
Compression	329	84	62
Riveting Machines (Not Portable)	2,216	1,175	253
OTHER SHOP EQUIPMENT	17,362	4,291	2,498
Electric Welding Machines (Not Hand)	3,366	761	252
Arc: Motor-generator set	1,236	197	44
Transformer	704	55	22
Automatic and other	230	62	7
Resistance: Spot	958	392	179
Projection	117	26	–
Gun	33	7	–
Seam	37	15	–
Butt and flash	51	7	–
Gas Welding, Cutting Machines (Not Hand)	292	92	–
Flame cutting	208	77	–
Welding	84	15	–
Balancing Machines	219	84	37
Air Compressors	541	110	84
Plating Equipment	334	65	29
Machines	30	–	–
Tanks	227	47	7
Barrels	77	18	22
Materials Heating Equipment	2,011	445	255
Heat-treating furnaces	1,365	299	102
Stock-heating furnaces	252	62	95
Salt baths	121	11	7
Induction heating units	18	–	–
Baking and drying ovens	237	69	51
Flame hardening	18	4	–
Cleaning Equipment	1,815	464	321
Tumbling barrels	691	131	267
Shot and abrasive blast	157	69	–
Parts washing machines	551	197	4
Pickling machines	164	27	10
Tanks	252	40	40
Cranes, Overhead Traveling	672	145	242
Hoists (Incl. Jib and Rail Mounting)	5,995	1,746	1,176
Chain, hand	2,384	817	836
Electric	3,048	743	210
Pneumatic	563	186	130
Industrial Trucks	2,117	379	102
Lift	1,244	304	97
Truck-tractor	249	54	5
Powered hand trucks	458	–	–
Crane	166	21	–

CENTRAL AND MOUNTAIN STATES



792 plants, 140,325 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**42,007**	**44%**	**20%**
Metal Forming	**9,717**	**51**	**19**
Other Equip.	**27,126**	**33**	**7**
Total	**78,850**	**42**	**16**

This area includes Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Montana, Idaho, Wyoming, Colorado, Arizona, New Mexico, Utah, and Nevada except counties covered in two preceding tables

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	42,007	10,133	8,592
Boring Machines	1,767	504	539
Horizontal boring, drilling, and milling	545	148	234
Vertical boring mills including vertical turret lathes	663	197	271
Precision, horizontal and vertical	376	111	11
Jig boring, horizontal and vertical	93	26	4
Other	90	22	19
Broaching Machines	364	115	68
Horizontal internal	154	45	41
Horizontal surface	30	7	–
Vertical internal	136	52	27
Vertical surface	33	11	–
Other	11	–	–
Contour sawing and filing	239	33	4
Cutoff Machines	2,266	400	286
Bandsaw	845	122	41
Abrasive disk	314	33	7
Hacksaws	846	189	193
Rotary, hot or cold	99	30	15
Other	162	26	30
Drilling Machines	9,497	2,100	2,047
Sensitive	2,548	520	419
Upright: Single-spindle	2,850	742	749
Gang	635	171	122
Radial	1,337	382	449
Multi-spindle cluster, adjustable & fixed center	480	122	171
Unit head and way type, multi-spindle	160	41	33
Deep-hole drills	96	48	22
Other	391	74	82
Gear Cutting and Finishing Machines	1,578	484	301
Hobbing machines	885	270	151
Shapers, gear	236	74	52
Cutters, form-milling type	41	15	22
Bevel gear cutters (not planer)	156	48	42
Cutters, planer type	4	–	–
Grinders, gear	6	–	–
Shavers, gear	70	11	–
Burnishing and lapping	30	11	–
Chamfering, tooth pointing, tooth rounding	39	30	4
Other	111	25	30
Gear Checking Machines	225	85	44
Grinding Machines	8,292	2,096	1,404
External cylindrical, plain and universal	762	219	116
Internal cylindrical	322	104	41
Centerless: External	212	41	19
Internal	10	3	–
Surface: Rotary table type	212	63	37
Reciprocating type	495	104	63
Disk, horizontal and vertical	445	137	89
Tool and cutter	1,434	472	293
Bench, floor-stand, and snag	3,517	902	716
Abrasive belt (not polishing)	322	26	–
Other	561	85	30
Honing and Lapping	371	55	33
Honing	219	33	7
Lapping: External	58	15	15
Internal	87	7	11
Surface	7	–	–
Lathes	9,313	2,066	2,086
Bench and floor, light-duty	1,660	368	282
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	2,871	801	701
Turret lathes: Ram type and hand screw	1,762	267	267
Saddle type	747	217	145
Automatic chucking, horizontal and vertical	178	56	41
Automatic between centers chucking	772	201	249
Automatic screw machines, bar	931	78	260
Gun and shaft boring	7	4	–
Other	385	74	141
Milling Machines	3,493	798	827
Bench type	107	33	11
Hand	543	122	169
Knee-type, horizontal	1,426	319	328
Vertical	461	111	67
Automatic and manufacturing	482	82	134
Bed (Lincoln) type, incl automatic rise and fall	90	26	15
Planer type	131	38	63
Die sinkers (except engraving) & duplicators	71	15	4
Other	182	52	26
Planers	315	89	171
Double housing	217	67	130
Openside	67	15	30
Other	31	7	11
Pipe Cutting and Threading Machines	416	160	48
Polishing and Buffing Machines	1,604	435	282
Speed lathes	422	134	26
Polishing stands	906	208	237
Abrasive belt	209	78	4
Other	67	15	15
Rifle Working Machines (not deep-hole drills)	4	4	–
Shapers	1,062	327	267
Horizontal	813	234	204
Vertical, including slotters	129	48	30
Keyseaters	120	45	33
Threading (except pipe)	1,015	337	148
Tapping	483	148	52
Hobbing and milling	140	67	26
Die type	269	96	70
Grinders, thread	38	7	–
Rolling machines, thread	7	4	–
Other	78	15	–
Other Machine Tools	186	45	37
METAL FORMING MACHINERY	9,717	3,143	1,860
Bending and Forming Machines	1,747	655	270
Bending rolls, sheet and plate	472	208	59
Bending rolls, bars and shapes	104	30	22
Power bending brakes	469	141	33
Rotary forming machines	93	37	26
Bending machines, pipe and bar	235	74	41
Other	377	165	89
Hydraulic Presses	998	232	105
Vertical, single action	564	156	48
Vertical, double and triple action	35	11	7
Horizontal	72	23	11
Other (including hydro-pneumatic)	327	42	39
Pneumatic Presses (except hydro-pneumatic)	382	55	22
Mechanical Presses, Power Driven	3,427	1,298	768
Inclinable	1,514	519	252
Vertical, C-frame	1,057	534	257
Vertical, straight-sided	594	156	204
Dieing machines	11	7	–
Horizontal	74	52	15
Other	177	30	45
Punching and Shearing Machines	1,906	553	449
Punching machines	600	160	182
Plate and sheet shears	810	226	110
Bar and angle shears	104	56	78
Rotary shears	220	85	70
Other	82	26	–
Forging Machinery (except presses)	422	86	127
Hammers, steam or air	159	38	30
Hammers, gravity drop	96	11	45
Hammers, helve	41	11	19
Forging machines (headers) and rolls	77	11	7
Other	49	15	26
Swaging Machines	148	85	7
Wire and Strip Forming Machines	74	19	4
Die Casting Machines	19	4	–
Hot chamber	19	4	–
Cold chamber	–	–	–
Plastic Molding Machines	23	–	–
Injection	4	–	–
Compression	19	–	–
Riveting Machines (Not Portable)	571	156	108
OTHER SHOP EQUIPMENT	27,126	7,123	1,967
Electric Welding Machines (Not Hand)	4,814	1,131	264
Arc: Motor-generator set	2,586	753	156
Transformer	850	70	–
Automatic and other	69	11	–
Resistance: Spot	957	223	89
Projection	93	7	–
Gun	97	22	–
Seam	66	19	–
Butt and flash	96	26	19
Gas Welding, Cutting Machines (Not Hand)	496	108	26
Flame cutting	366	63	22
Welding	130	45	4
Balancing Machines	113	22	4
Air Compressors	1,304	241	141
Plating Equipment	1,054	300	11
Machines	143	78	4
Tanks	655	200	7
Barrels	256	22	–
Materials Heating Equipment	2,213	682	257
Heat-treating furnaces	1,022	319	119
Stock-heating furnaces	371	111	78
Salt baths	258	78	11
Induction heating units	88	7	–
Baking and drying ovens	415	152	45
Flame hardning	59	15	4
Cleaning Equipment	1,812	414	189
Tumbling barrels	448	104	67
Shot and abrasive blast	338	78	33
Parts washing machines	566	146	89
Pickling machines	44	4	–
Tanks	416	82	–
Cranes, Overhead Traveling	909	224	89
Hoists (Incl. Jib and Rail Mounting)	9,718	2,183	771
Chain, hand	4,174	1,161	512
Electric	4,332	1,014	163
Pneumatic	1,212	408	96
Industrial Trucks	4,693	1,418	215
Lift	2,487	694	85
Truck-tractor	886	111	115
Powered hand trucks	997	479	–
Crane	323	134	15

HOUSTON

118 plants, 21,987 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**6,772**	**43%**	**12%**
Metal Forming	**445**	**48**	**18**
Other Equip.	**5,204**	**38**	**6**
Total	**12,421**	**41**	**10**

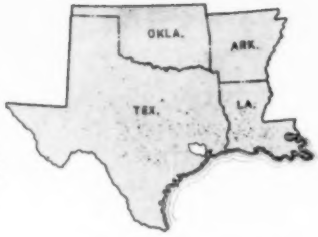
This marketing area includes Harris County, Texas

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	6,772	2,959	866
Boring Machines	133	16	38
Horizontal boring, drilling, and milling	51	8	8
Vertical boring mills (including vertical turret lathes	52	8	22
Precision, horizontal and vertical	7	–	–
Jig boring, horizontal and vertical	15	–	8
Other	8	–	–
Broaching Machines	25	9	–
Horizontal internal	8	–	–
Horizontal surface	3	–	–
Vertical internal	3	3	–
Vertical surface	11	6	–
Other	–	–	–
Contour sawing and filing	17	6	–
Cutoff Machines	278	63	30
Bandsaw	64	11	8
Abrasive disk	34	3	–
Hacksaws	147	44	8
Rotary, hot or cold	11	3	8
Other	22	3	6
Drilling Machines	762	227	134
Sensitive	75	8	6
Upright: Single-spindle	378	129	72
Gang	53	25	3
Radial	158	47	50
Multi-spindle cluster, adjustable & fixed center	17	6	–
Unit head and way type, multi-spindle	–	–	–
Deep-hole drills	42	6	–
Other	39	6	3
Gear Cutting and Finishing Machines	184	61	64
Hobbing machines	39	17	3
Shapers, gear	9	–	3
Cutters, form-milling type	120	44	58
Bevel gear cutters (not planer)	3	–	–
Cutters, planer type	–	–	–
Grinders, gear	3	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	–	–	–
Grinding Machines	2,049	644	230
External cylindrical, plain and universal	167	42	11
Internal cylindrical	171	55	19
Centerless: External	56	25	3
Internal	1	–	–
Surface: Rotary table type	66	14	17
Reciprocating type	58	6	3
Disk, horizontal and vertical	25	–	–
Tool and cutter	496	100	33
Bench, floorstand, and snag	865	393	144
Abrasive belt (not polishing)	38	9	–
Other	106	–	–
Honing and Lapping	50	6	–
Honing	25	6	–
Lapping: External	8	–	–
Internal	17	–	–
Surface	–	–	–
Lathes	2,048	715	229
Bench and floor, light-duty	78	15	11
Engine, heavy-duty, incl toolroom, mfg, aut turret, gap	688	271	133
Turret lathes: Ram type and hand screw	596	236	66
Saddle type	272	102	11
Automatic chucking, horizontal and vertical	97	14	–
Automatic between centers chucking	108	25	–
Automatic screw machines, bar	136	42	8
Gun and shaft boring	19	–	–
Other	54	8	–
Milling Machines	661	128	109
Bench type	6	–	–
Hand	19	3	3
Knee-type, horizontal	343	80	100
Vertical	122	9	–
Automatic and manufacturing	66	–	–
Bed (Lincoln) type, incl automatic rise and fall	19	3	–
Planer type	8	–	–
Die sinkers (except engraving) & duplicators	29	11	3
Other	49	22	3
Planers	15	6	6
Double housing	9	3	6
Openside	3	–	–
Other	3	3	–
Pipe Cutting and Threading Machines	45	20	–
Polishing and Buffing Machines	53	17	–
Speed lathes	33	17	–
Polishing stands	11	–	–
Abrasive belt	9	–	–
Other	–	–	–
Rifle Working Machines (not deep-hole drills)	3	–	–
Shapers	143	49	20
Horizontal	88	30	14
Vertical, including slotters	44	11	6
Keyseaters	11	8	–
Threading (except pipe)	273	89	6
Tapping	17	–	–
Hobbing and milling	144	69	6
Die type	14	3	–
Grinders, thread	61	3	–
Rolling machines, thread	–	–	–
Other	37	14	–
Other Machine Tools	33	3	–
METAL FORMING MACHINERY	445	132	81
Bending and Forming Machines	39	11	3
Bending rolls, sheet and plate	11	8	–
Bending rolls, bars and shapes	3	–	–
Power bending brakes	8	–	–
Rotary forming machines	3	3	–
Bending machines, pipe and bar	–	–	–
Other	14	–	3
Hydraulic Presses	118	36	3
Vertical, single action	104	25	3
Vertical, double and triple action	3	–	–
Horizontal	11	11	–
Other (including hydro-pneumatic)	–	–	–
Pneumatic Presses (except hydro-pneumatic)	30	8	3
Mechanical Presses, Power Driven	138	47	31
Inclinable	8	–	3
Vertical, C-frame	8	8	–
Vertical, straight-sided	58	17	22
Dieing machines	–	–	–
Horizontal	6	–	–
Other	58	22	6
Punching and Shearing Machines	64	12	17
Punching machines	3	–	–
Plate and sheet shears	28	–	11
Bar and angle shears	16	–	6
Rotary shears	6	6	–
Other	11	6	–
Forging Machinery (except presses)	41	9	24
Hammers, steam or air	18	–	14
Hammers, gravity drop	14	6	6
Hammers, helve	–	–	–
Forging machines (headers) and rolls	6	3	1
Other	3	–	3
Swaging Machines	3	3	–
Wire and Strip Forming Machines	–	–	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	12	6	–
OTHER SHOP EQUIPMENT	5,204	1,686	306
Electric Welding Machines (Not Hand)	737	208	53
Arc: Motor-generator set	286	105	47
Transformer	417	89	–
Automatic and other	1	–	–
Resistance: Spot	19	8	3
Projection	–	–	–
Gun	–	–	–
Seam	–	–	–
Butt and flash	14	6	3
Gas Welding, Cutting Machines (Not Hand)	73	39	–
Flame cutting	58	28	–
Welding	15	11	–
Balancing Machines	11	3	–
Air Compressors	129	30	25
Plating Equipment	110	33	–
Machines	19	8	–
Tanks	66	8	–
Barrels	25	17	–
Materials Heating Equipment	764	269	153
Heat-treating furnaces	570	213	147
Stock-heating furnaces	58	17	6
Salt baths	50	22	–
Induction heating units	71	11	–
Baking and drying ovens	7	3	–
Flame hardening	8	3	–
Cleaning Equipment	203	66	20
Tumbling barrels	22	8	–
Shot and abrasive blast	79	33	14
Parts washing machines	80	25	6
Pickling machines	–	–	–
Tanks	22	–	–
Cranes, Overhead Traveling	335	105	14
Hoists (Incl. Jib and Rail Mounting)	2,250	770	41
Chain, hand	973	399	–
Electric	1,115	297	34
Pneumatic	162	74	7
Industrial Trucks	592	163	–
Lift	194	37	–
Truck-tractor	118	17	–
Powered hand trucks	230	95	–
Crane	50	14	–

SOUTHWESTERN STATES

539 plants, 88,261 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**29,373**	**39%**	**17%**
Metal Forming	**8,505**	**47**	**23**
Other Equip.	**24,796**	**24**	**5**
Total	**62,674**	**34**	**13**



This area includes Arkansas, Louisiana, Oklahoma, and Texas (except Harris County)

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	29,373	6,472	5,074
Boring Machines	1,059	242	447
Horizontal boring, drilling, and milling	280	85	133
Vertical boring mills including vertical turret lathes	607	121	266
Precision, horizontal and vertical	73	24	24
Jig boring, horizontal and vertical	74	12	–
Other	25	–	24
Broaching Machines	91	31	24
Horizontal internal	66	31	24
Horizontal surface	–	–	–
Vertical internal	23	–	–
Vertical surface	–	–	–
Other	–	–	–
Contour sawing and filing	122	–	–
Cutoff Machines	3,240	411	145
Bandsaw	1,352	157	36
Abrasive disk	293	36	–
Hacksaws	1,351	194	73
Rotary, hot or cold	121	24	12
Other	123	–	24
Drilling Machines	5,732	1,150	556
Sensitive	702	218	36
Upright: Single-spindle	3,688	629	351
Gang	315	36	12
Radial	650	133	133
Multi-spindle cluster, adjustable & fixed center	97	24	–
Unit head and way type, multi-spindle	24	12	–
Deep-hole drills	36	–	12
Other	220	48	12
Gear Cutting and Finishing Machines	243	97	73
Hobbing machines	97	61	–
Shapers, gear	24	–	–
Cutters, form-milling type	109	36	73
Bevel gear cutters (not planer)	–	–	–
Cutters, planer type	–	–	–
Grinders, gear	1	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	12	–	–
Gear Checking Machines	12	–	–
Grinding Machines	6,148	1,332	703
External cylindrical, plain and universal	397	85	97
Internal cylindrical	157	24	61
Centerless: External	25	–	–
Internal	–	–	–
Surface: Rotary table type	243	61	61
Reciprocating type	192	24	–
Disk, horizontal and vertical	157	12	12
Tool and cutter	924	194	109
Bench, floor stand, and snag	3,276	908	327
Abrasive belt (not polishing)	473	24	24
Other	304	–	12
Honing and Lapping	102	36	–
Honing	89	36	–
Lapping: External	13	–	–
Internal	–	–	–
Surface	–	–	–
Lathes	7,398	1,757	1,743
Bench and floor, light-duty	1,516	363	24
Engine, heavy-duty, incl toolroom, mfg, and form, gap	3,698	932	1,562
Turret lathes: Ram type and hand screw	1,154	194	48
Saddle type	612	242	73
Automatic chucking, horizontal and vertical	24	–	–
Automatic between centers chucking	–	–	–
Automatic screw machines, bar	266	–	–
Gun and shaft boring	48	14	12
Other	80	12	24
Milling Machines	1,973	484	484
Bench type	94	–	–
Hand	242	85	24
Knee-type, horizontal	769	266	182
Vertical	354	24	12
Automatic and manufacturing	242	–	121
Bed (Lincoln) type, incl automatic rise and fall	12	12	–
Planer type	24	–	24
Die sinkers (except engraving) & duplicators	–	–	–
Other	236	97	121
Planers	282	72	182
Double housing	146	48	85
Openside	88	12	73
Other	48	12	24
Pipe Cutting and Threading Machines	747	182	121
Polishing and Buffing Machines	598	194	73
Speed lathes	169	48	–
Polishing stands	280	85	73
Abrasive belt	137	61	–
Other	12	–	–
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	833	339	266
Horizontal	541	218	169
Vertical, including slotters	26	12	–
Keyseaters	266	109	97
Threading (except pipe)	684	133	233
Tapping	185	36	–
Hobbing and milling	157	73	–
Die type	88	24	48
Grinders, thread	36	–	–
Rolling machines, thread	12	–	–
Other	206	–	185
Other Machine Tools	109	12	24
METAL FORMING MACHINERY	8,505	2,028	1,950
Bending and Forming Machines	2,486	448	521
Bending rolls, sheet and plate	762	109	266
Bending rolls, bars and shapes	210	48	61
Power bending brakes	805	97	61
Rotary forming machines	147	12	48
Bending machines, pipe and bar	376	121	73
Other	186	61	12
Hydraulic Presses	877	244	182
Vertical, single action	568	184	85
Vertical, double and triple action	85	–	12
Horizontal	151	48	61
Other (excluding hydro-pneumatic)	73	12	24
Pneumatic Presses (except hydro-pneumatic)	110	16	–
Mechanical Presses, Power Driven	1,707	399	279
Inclinable	1,041	242	73
Vertical, C-frame	182	48	61
Vertical, straight-sided	266	85	36
Dieing machines	–	–	–
Horizontal	36	24	–
Other	182	–	109
Punching and Shearing Machines	2,634	739	750
Punching machines	1,033	460	327
Plate and sheet shears	662	98	97
Bar and angle shears	606	145	169
Rotary shears	219	–	145
Other	114	36	12
Forging Machinery (except presses)	329	85	109
Hammers, steam or air	171	36	85
Hammers, gravity drop	36	13	–
Hammers, helve	24	–	24
Forging machines (headers) and rolls	–	–	–
Other	98	36	–
Swaging Machines	–	–	–
Wire and Strip Forming Machines	–	–	–
Die Casting Machines	12	–	12
Hot chamber	12	–	12
Cold chamber	–	–	–
Plastic Molding Machines	72	24	–
Injection	72	24	–
Compression	–	–	–
Riveting Machines (Not Portable)	278	73	97
OTHER SHOP EQUIPMENT	24,796	4,740	1,239
Electric Welding Machines (Not Hand)	6,789	1,294	146
Arc: Motor-generator set	4,479	1,089	61
Transformer	1,044	48	–
Automatic and other	275	–	–
Resistance: Spot	805	121	61
Projection	1	–	–
Gun	75	12	–
Seam	37	–	–
Butt and flash	73	24	24
Gas Welding, Cutting Machines (Not Hand)	1,637	133	–
Flame cutting	1,127	97	–
Welding	510	36	–
Balancing Machines	86	12	–
Air Compressors	1,977	315	306
Plating Equipment	375	205	–
Machines	85	24	–
Tanks	266	169	–
Barrels	24	12	–
Materials Heating Equipment	1,344	265	121
Heat-treating furnaces	651	157	73
Stock-heating furnaces	173	36	48
Salt baths	169	24	–
Induction heating units	36	–	–
Baking and drying ovens	242	48	–
Flame hardening	73	–	–
Cleaning Equipment	1,278	169	97
Tumbling barrels	230	48	97
Shot and abrasive blast	232	73	–
Parts washing machines	172	12	–
Pickling machines	12	–	–
Tanks	632	36	–
Cranes, Overhead Traveling	1,512	242	327
Hoists (Incl. Jib and Rail Mounting)	8,334	1,960	242
Chain, hand	4,324	1,500	157
Electric	3,675	399	85
Pneumatic	235	61	–
Industrial Trucks	1,564	145	–
Lift	902	85	–
Truck-tractor	355	36	–
Powered hand trucks	109	–	–
Crane	198	24	–

SAN FRANCISCO—OAKLAND

298 plants, 50,206 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**12,375**	**42%**	**19%**
Metal Forming	**4,153**	**59**	**26**
Other Equip.	**9,167**	**44**	**11**
Total	**25,695**	**46**	**18**

This marketing area includes Alameda, Contra Costa, San Francisco, San Mateo, and Marin counties in California

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	12,375	2,802	2,449
Boring Machines	418	129	142
Horizontal boring, drilling, and milling	103	39	26
Vertical boring mills including vertical turret lathes	225	58	116
Precision, horizontal and vertical	45	32	–
Jig boring, horizontal and vertical	32	–	–
Other	13	–	–
Broaching Machines	31	6	6
Horizontal internal	6	–	–
Horizontal surface	6	6	–
Vertical internal	19	–	6
Vertical surface	–	–	–
Other	–	–	–
Contour sawing and filing	52	13	–
Cutoff Machines	747	200	89
Bandsaw	290	52	19
Abrasive disk	90	26	–
Hacksaws	335	122	64
Rotary, hot or cold	32	–	6
Other	–	–	–
Drilling Machines	3,281	682	411
Sensitive	1,043	187	6
Upright: Single-spindle	1,349	283	232
Gang	206	45	77
Radial	303	90	90
Multi-spindle cluster, adjustable & fixed center	39	6	6
Unit head and way type, multi-spindle	45	–	–
Deep-hole drills	58	–	–
Other	238	71	–
Gear Cutting and Finishing Machines	244	32	147
Hobbing machines	84	–	45
Shapers, gear	64	–	52
Cutters, form-milling type	52	19	32
Bevel gear cutters (not planer)	32	13	6
Cutters, planer type	6	–	6
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	6	–	6
Other	–	–	–
Gear Checking Machines	6	6	–
Grinding Machines	2,158	553	291
External cylindrical, plain and universal	219	71	26
Internal cylindrical	71	45	–
Centerless: External	13	–	–
Internal	–	–	–
Surface: Rotary table type	39	6	13
Reciprocating type	193	32	13
Disk, horizontal and vertical	135	45	39
Tool and cutter	348	109	45
Bench, floorstand, and snag	895	206	142
Abrasive belt (not polishing)	219	26	13
Other	26	13	–
Honing and Lapping	6	–	–
Honing	–	–	–
Lapping: External	6	–	–
Internal	–	–	–
Surface	–	–	–
Lathes	3,385	630	728
Bench and floor, light-duty	647	116	45
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	1,127	270	496
Turret lathes: Ram type and hand screw	573	161	103
Saddle type	161	39	52
Automatic chucking, horizontal and vertical	13	6	–
Automatic between centers chucking	–	–	–
Automatic screw machines, bar	838	19	26
Gun and shaft boring	–	–	–
Other	26	19	6
Milling Machines	1,055	276	224
Bench type	109	39	–
Hand	187	64	19
Knee-type, horizontal	412	103	129
Vertical	180	39	45
Automatic and manufacturing	32	13	6
Bed (Lincoln) type, incl automatic rise and fall	32	6	6
Planer type	13	6	6
Die sinkers (except engraving) & duplicators	32	6	–
Other	58	–	13
Planers	135	19	110
Double housing	64	13	52
Openside	45	–	39
Other	26	6	19
Pipe Cutting and Threading Machines	142	45	32
Polishing and Buffing Machines	206	70	26
Speed lathes	39	19	–
Polishing stands	116	26	26
Abrasive belt	32	6	–
Other	19	19	–
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	277	58	160
Horizontal	200	39	122
Vertical, including slotters	6	–	6
Keyseaters	71	19	32
Threading (except pipe)	129	51	51
Tapping	52	26	19
Hobbing and milling	19	19	–
Die type	13	6	6
Grinders, thread	6	–	–
Rolling machines, thread	39	–	26
Other	–	–	–
Other Machine Tools	103	32	32
METAL FORMING MACHINERY	4,153	1,352	1,091
Bending and Forming Machines	676	213	213
Bending rolls, sheet and plate	251	77	129
Bending rolls, bars and shapes	45	26	13
Power bending brakes	206	58	26
Rotary forming machines	26	–	19
Bending machines, pipe and bar	71	26	–
Other	77	26	26
Hydraulic Presses	239	51	97
Vertical, single action	148	45	58
Vertical, double and triple action	39	6	13
Horizontal	26	–	13
Other (including hydro-pneumatic)	26	–	13
Pneumatic Presses (except hydro-pneumatic)	6	6	–
Mechanical Presses, Power Driven	1,616	515	267
Inclinable	869	167	77
Vertical, C-frame	374	219	58
Vertical, straight-sided	270	97	116
Dieing machines	–	–	–
Horizontal	13	–	3
Other	90	32	13
Punching and Shearing Machines	862	329	373
Punching machines	386	155	200
Plate and sheet shears	261	116	90
Bar and angle shears	77	6	45
Rotary shears	64	39	19
Other	52	13	19
Forging Machinery (except presses)	233	90	116
Hammers, steam or air	71	6	58
Hammers, gravity drop	39	26	–
Hammers, helve	32	13	13
Forging machines (headers) and rolls	39	13	26
Other	52	32	19
Swaging Machines	26	–	6
Wire and Strip Forming Machines	32	–	–
Die Casting Machines	–	–	–
Hot chamber	19	19	–
Cold chamber	19	19	–
Plastic Molding Machines	122	–	–
Injection	122	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	322	129	19
OTHER SHOP EQUIPMENT	9,167	2,990	1,033
Electric Welding Machines (Not Hand)	2,004	455	57
Arc: Motor-generator set	1,365	193	32
Transformer	155	58	–
Automatic and other	161	19	6
Resistance: Spot	213	135	19
Projection	26	6	–
Gun	6	6	–
Seam	39	19	–
Butt and flash	39	19	–
Gas Welding, Cutting Machines (Not Hand)	309	77	–
Flame cutting	245	64	–
Welding	64	13	–
Balancing Machines	45	–	–
Air Compressors	528	90	135
Plating Equipment	283	–	–
Machines	6	–	–
Tanks	225	–	–
Barrels	52	–	–
Materials Heating Equipment	780	265	148
Heat-treating furnaces	374	97	142
Stock-heating furnaces	251	116	6
Salt baths	71	13	–
Induction heating units	–	–	–
Baking and drying ovens	71	26	–
Flame hardening	13	13	–
Cleaning Equipment	496	110	6
Tumbling barrels	155	26	6
Shot and abrasive blast	71	26	–
Parts washing machines	77	6	–
Pickling machines	6	–	–
Tanks	97	52	–
Cranes, Overhead Traveling	648	191	172
Hoists (Incl. Jib and Rail Mounting)	3,364	1,639	486
Chain, hand	1,782	1,077	191
Electric	1,334	410	257
Pneumatic	248	152	38
Industrial Trucks	800	163	29
Lift	410	86	–
Truck-tractor	95	–	–
Powered hand trucks	200	67	–
Crane	95	10	29

LOS ANGELES

878 plants, 166,104 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**30,368**	**24%**	**6%**
Metal Forming	**8,589**	**26**	**7**
Other Equip.	**17,782**	**19**	**5**
Total	**56,739**	**22**	**6**

This marketing area includes Los Angeles County in California

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	30,368	5,316	1,885
Boring Machines	726	151	115
Horizontal boring, drilling, and milling	259	55	39
Vertical boring mills, including vertical turret lathes	260	80	57
Precision, horizontal and vertical	106	3	6
Jig boring, horizontal and vertical	102	10	9
Other	29	–	–
Broaching Machines	110	33	–
Horizontal internal	58	22	–
Horizontal surface	10	–	–
Vertical internal	26	8	–
Vertical surface	6	–	–
Other	10	–	–
Contour sawing and filing	140	16	–
Cutoff Machines	2,269	376	75
Bandsaw	960	154	10
Abrasive disk	343	76	7
Hacksaws	641	129	42
Rotary, hot or cold	247	55	10
Other	128	26	10
Drilling Machines	7,831	1,285	311
Sensitive	1,778	292	22
Upright: Single-spindle	3,959	546	182
Gang	758	45	29
Radial	642	158	55
Multi-spindle cluster, adjustable & fixed center	202	42	22
Unit head and way type, multi-spindle	148	19	–
Deep-hole drills	32	16	–
Other	302	87	–
Gear Cutting and Finishing Machines	298	102	58
Hobbing machines	83	22	15
Shapers, gear	116	39	13
Cutters, form-milling type	61	26	22
Bevel gear cutters (not planer)	33	6	–
Cutters, planer type	33	3	10
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	5	6	–
Chamfering, tooth pointing, tooth rounding	3	–	–
Other	–	–	–
Gear Checking Machines	22	–	–
Grinding Machines	6,809	1,154	294
External cylindrical, plain and universal	327	77	58
Internal cylindrical	161	39	29
Centerless: External	135	10	6
Internal	12	5	2
Surface: Rotary table type	135	29	13
Reciprocating type	401	55	10
Disk, horizontal and vertical	346	128	6
Tool and cutter	1,085	205	55
Bench, floor-stand, and sensg	3,327	539	83
Abrasive belt (not polishing)	648	19	–
Other	274	48	22
Honing and Lapping	282	19	10
Honing	202	13	10
Lapping: External	33	–	–
Internal	48	–	–
Surface	19	6	–
Lathes	5,797	1,102	617
Bench and floor, light-duty	1,165	202	25
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	2,202	475	321
Turret lathes: Ram type and hand screw	1,114	189	71
Saddle type	439	83	103
Automatic chucking, horizontal and vertical	254	35	39
Automatic between centers chucking	83	19	–
Automatic screw machines, bar	399	45	29
Gun and shaft boring	6	6	–
Other	116	48	19
Milling Machines	2,866	456	124
Bench type	116	13	6
Hand	327	71	16
Knee-type, horizontal	1,223	244	45
Vertical	549	42	22
Automatic and manufacturing	241	–	3
Bed (Lincoln) type, incl automatic rise and fall	35	3	–
Planer type	61	13	22
Die sinkers (except engraving) & duplicators	128	19	10
Other	186	51	–
Planers	141	29	58
Double housing	61	10	39
Openside	67	10	16
Other	13	–	3
Pipe Cutting and Threading Machines	189	67	22
Polishing and Buffing Machines	935	162	58
Speed lathes	257	10	6
Polishing stands	421	100	39
Abrasive belt	180	26	13
Other	77	26	–
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	655	193	102
Horizontal	485	135	67
Vertical, including slotters	67	10	3
Keyseaters	103	48	32
Threading (except pipe)	411	54	22
Tapping	225	29	10
Hobbing and milling	42	13	6
Die type	51	6	6
Grinders, thread	64	–	–
Rolling machines, thread	16	3	–
Other	13	3	–
Other Machine Tools	687	119	19
METAL FORMING MACHINERY	8,589	1,612	658
Bending and Forming Machines	1,355	282	70
Bending rolls, sheet and plate	347	103	45
Bending rolls, bars and shapes	132	29	–
Power bending brakes	462	96	22
Rotary forming machines	45	6	3
Bending machines, pipe and bar	154	19	–
Other	215	29	–
Hydraulic Presses	588	96	55
Vertical, single action	424	90	42
Vertical, double and triple action	42	–	–
Horizontal	71	6	13
Other (including hydro-pneumatic)	51	–	–
Pneumatic Presses (except hydro-pneumatic)	87	19	–
Mechanical Presses, Power Driven	2,115	687	283
Inclinable	1,999	347	128
Vertical, C-frame	414	106	39
Vertical, straight-sided	510	128	71
Dining machines	–	–	–
Horizontal	39	6	13
Other	173	100	32
Punching and Shearing Machines	1,262	266	145
Punching machines	395	64	58
Plate and sheet shears	610	151	64
Bar and angle shears	55	16	10
Rotary shears	138	29	3
Other	64	6	10
Forging Machinery (except presses)	340	79	76
Hammers, steam or air	119	6	48
Hammers, gravity drop	83	35	3
Hammers, helve	16	6	3
Forging machines (headers) and rolls	42	19	6
Other	80	13	13
Swaging Machines	61	3	10
Wire and Strip Forming Machines	32	10	–
Die Casting Machines	122	–	6
Hot chamber	51	–	6
Cold chamber	71	–	–
Plastic Molding Machines	211	51	13
Injection	22	6	–
Compression	189	45	13
Riveting Machines (Not Portable)	1,416	119	–
OTHER SHOP EQUIPMENT	17,782	2,441	879
Electric Welding Machines (Not Hand)	3,991	635	16
Arc: Motor-generator set	2,337	388	3
Transformer	353	16	–
Automatic and other	227	77	–
Resistance: Spot	758	138	13
Projection	22	–	–
Gun	58	3	–
Seam	55	–	–
Butt and flash	71	13	–
Gas Welding, Cutting Machines (Not Hand)	337	28	–
Flame cutting	247	22	–
Welding	90	6	–
Balancing Machines	67	16	–
Air Compressors	1,218	202	35
Plating Equipment	1,456	13	–
Machines	45	–	–
Tanks	1,339	10	–
Barrels	74	3	–
Materials Heating Equipment	1,611	336	22
Heat-treating furnaces	870	218	16
Stock-heating furnaces	205	61	–
Salt baths	138	3	–
Induction heating units	64	6	–
Baking and drying ovens	295	35	6
Flame hardening	39	13	–
Cleaning Equipment	1,348	157	6
Tumbling barrels	244	35	3
Shot and abrasive blast	170	29	3
Parts washing machines	186	29	–
Pickling machines	42	–	–
Tanks	706	64	–
Cranes, Overhead Traveling	880	148	87
Hoists (Incl. Jib and Rail Mounting)	5,078	762	713
Chain, hand	2,523	376	546
Electric	2,125	225	100
Pneumatic	430	161	67
Industrial Trucks	1,794	144	–
Lift	1,078	96	–
Truck-tractor	244	32	–
Powered hand trucks	379	–	–
Crane	93	16	–

PACIFIC COAST

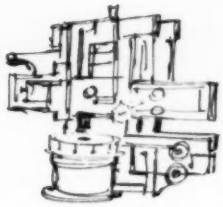
435 plants, 137,599 employees
(in plants with 21 or more workers)

	Units	10 yr & over	Over 20 yr
Machine Tools	**18,725**	**26%**	**8%**
Metal Forming	**5,243**	**25**	**6**
Other Equip.	**10,830**	**15**	**2**
Total	**34,798**	**22**	**6**

This area includes Washington, Oregon, and California except counties covered in other tables

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	18,725	3,414	1,457
Boring Machines	544	140	99
Horizontal boring, drilling, and milling	211	61	44
Vertical boring mills, including vertical turret lathes	200	64	55
Precision, horizontal and vertical	36	6	–
Jig boring, horizontal and vertical	68	9	–
Other	29	–	–
Broaching Machines	56	12	9
Horizontal internal	23	–	9
Horizontal surface	3	9	–
Vertical internal	18	3	–
Vertical surface	12	–	–
Other	–	–	–
Contour sawing and filing	175	6	–
Cutoff Machines	1,900	349	88
Bandsaw	979	123	41
Abrasive disk	178	18	3
Hacksaws	349	115	44
Rotary, hot or cold	193	67	–
Other	151	26	–
Drilling Machines	4,569	803	171
Sensitive	794	321	7
Upright: Single-spindle	2,634	305	70
Gang	225	51	9
Radial	400	94	53
Multi-spindle cluster, adjustable & fixed center	61	15	3
Unit head and way type, multi-spindle	123	–	23
Deep-hole drills	9	3	–
Other	223	14	6
Gear Cutting and Finishing Machines	511	73	108
Hobbing machines	123	35	41
Shapers, gear	67	20	12
Cutters, form-milling type	260	18	23
Bevel gear cutters (not planer)	26	–	9
Cutters, planer type	23	–	23
Grinders, gear	3	–	–
Shavers, gear	3	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	6	–	–
Other	–	–	–
Gear Checking Machines	29	–	6
Grinding Machines	5,139	934	187
External cylindrical, plain and universal	202	36	44
Internal cylindrical	120	20	23
Centerless: External	30	6	–
Internal	3	–	–
Surface: Rotary table type	56	9	3
Reciprocating type	188	23	15
Disk, horizontal and vertical	780	85	6
Tool and cutter	564	123	29
Bench, floorstand, and snag	2,498	577	55
Abrasive belt (not polishing)	463	47	3
Other	235	8	9
Honing and Lapping	54	9	
Honing	38	6	–
Lapping: External	15	3	–
Internal	1	–	–
Surface	–	–	–
Lathes	2,828	571	444
Bench and floor, light-duty	628	101	32
Engine, heavy-duty, incl toolroom, mfg, automatic, gap	1,307	324	330
Turret lathes: Ram type and hand screw	363	68	20
Saddle type	254	41	32
Automatic chucking, horizontal and vertical	55	9	18
Automatic between centers chucking	12	6	–
Automatic screw machines, bar	165	19	6
Gun and shaft boring	–	–	–
Other	44	3	6
Milling Machines	1,333	247	104
Bench type	60	–	–
Hand	168	25	12
Knee-type, horizontal	700	160	68
Vertical	176	32	12
Automatic and manufacturing	79	–	–
Bed (Lincoln) type, incl automatic rise and fall	20	–	3
Planer type	23	12	–
Die sinkers (except engraving) & duplicators	35	3	6
Other	72	5	7
Planers	151	23	70
Double housing	55	20	35
Openside	86	3	26
Other	10	–	9
Pipe Cutting and Threading Machines	170	44	18
Polishing and Buffing Machines	453	60	12
Speed lathes	111	12	3
Polishing stands	180	44	9
Abrasive belt	67	4	–
Other	95	–	–
Rifle Boring Machines (not deep-hole drills)	12		
Shapers	471	83	117
Horizontal	347	59	67
Vertical, including slotters	53	12	12
Keyseaters	69	12	38
Threading (except pipe)	216	31	18
Tapping	110	18	6
Hobbing and milling	18	–	–
Die type	44	10	12
Grinders, thread	32	–	–
Rolling machines, thread	–	–	–
Other	12	3	–
Other Machine Tools	114	29	6
METAL FORMING MACHINERY	5,243	1,009	287
Bending and Forming Machines	1,090	178	65
Bending rolls, sheet and plate	234	53	35
Bending rolls, bars and shapes	85	18	9
Power bending brakes	250	53	3
Rotary forming machines	70	15	–
Bending machines, pipe and tar	179	23	3
Other	252	16	15
Hydraulic Presses	409	107	55
Vertical, single action	234	63	26
Vertical, double and triple action	47	15	2
Horizontal	85	23	26
Other (including hydro-pneumatic)	43	6	–
Pneumatic Presses (except hydro-pneumatic)	26	–	–
Mechanical Presses, Power Driven	800	193	21
Inclinable	456	134	6
Vertical, C-frame	178	28	–
Vertical, straight-sided	80	12	–
Dieing machines	3	–	–
Horizontal	18	9	6
Other	65	18	9
Punching and Shearing Machines	1,440	337	106
Punching machines	558	105	36
Plate and sheet shears	528	121	48
Bar and angle shears	96	53	15
Rotary shears	73	29	3
Other	185	29	4
Forging Machinery (except presses)	450	134	31
Hammers, steam or air	159	43	16
Hammers, gravity drop	201	35	–
Hammers, helve	9	3	6
Forging machines (headers) and rolls	26	9	6
Other	55	44	3
Swaging Machines	93	6	–
Wire and Strip Forming Machines	12	–	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	6	–	–
Injection	6	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	917	54	9
OTHER SHOP EQUIPMENT	10,830	1,367	206
Electric Welding Machines (Not Hand)	3,186	473	2
Arc: Motor-generator set	2,270	383	2
Transformer	246	32	–
Automatic and other	96	3	–
Resistance: Spot	460	55	–
Projection	3	–	–
Gun	29	–	–
Seam	38	–	–
Butt and flash	44	–	–
Gas Welding, Cutting Machines (Not Hand)	316	58	–
Flame cutting	231	55	–
Welding	85	3	–
Balancing Machines	29	12	–
Air Compressors	965	89	56
Plating Equipment	203	3	3
Machines	36	–	3
Tanks	132	–	–
Barrels	35	3	–
Materials Heating Equipment	765	118	21
Heat-treating furnaces	354	59	15
Stock-heating furnaces	82	12	3
Salt baths	117	23	–
Induction heating units	68	6	–
Baking and drying ovens	125	15	3
Flame hardening	20	3	–
Cleaning Equipment	821	79	12
Tumbling barrels	115	57	6
Shot and abrasive blast	147	13	6
Parts washing machine	81	–	–
Pickling machines	35	–	–
Tanks	443	9	–
Cranes, Overhead Traveling	497	55	55
Hoists (Incl. Jib and Rail Mounting)	7,856	455	53
Chain, hand	1,438	359	35
Electric	1,294	55	–
Pneumatic	124	41	18
Industrial Trucks	1,191	45	4
Lift	839	23	3
Truck-tractor	179	3	–
Powered hand trucks	47	–	–
Crane	126	19	1

BORING MACHINES

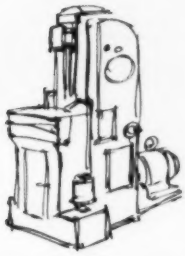


(Standard Commodity Code: 3411 00) Includes Horizontal boring, drilling and milling, floor and table types (3411 10); vertical boring mills, including vertical turret lathes (3411 20); precision, horizontal and vertical (3411 30); jig boring, horizontal and vertical (3411 40); misc. horizontal and vertical, not including precision types, and others (3411 50 & 90)

56,011 machines—43% at least 10 years old; 21% over 20 years old

	TOTAL BORING MACHINES			HORIZONTAL BORING, DRILLING AND MILLING			VERTICAL BORING MILLS INCL VERT TURRET LATHES			PRECISION HORIZONTAL AND VERTICAL			JIG BORING HORIZONTAL AND VERTICAL			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	2,387	612	640	820	173	266	820	204	325	522	142	14	83	31	7	142	62	28
Construction, Mining, Oil Well	2,231	641	591	868	294	234	1,109	287	327	127	43	7	80	7	23	47	10	–
Metalworking Machinery	6,840	1,528	1,375	3,100	725	718	1,654	356	409	698	126	105	1,167	228	90	221	93	53
Special – Industrial Equipment	4,234	944	1,232	1,529	408	315	1,899	381	806	348	88	11	359	61	61	99	6	39
General Industrial Equipment	4,242	1,115	976	1,167	389	312	1,930	532	551	730	95	66	239	44	7	176	55	40
Office and Store Machines	330	106	61	41	4	12	4	4	–	73	33	–	208	65	49	4	–	–
Domestic and Service Equip.	1,863	435	164	382	93	43	200	64	39	990	246	25	187	22	32	104	10	25
Electrical Equipment	4,670	848	925	1,126	259	181	1,752	260	629	688	117	5	896	172	70	208	40	40
Misc. Machine Parts, Jobbing	2,868	862	595	1,118	403	238	1,026	330	321	165	55	–	357	37	18	202	37	18
Motor Vehicles and Parts	4,019	1,226	442	975	290	164	658	216	127	1,497	389	58	297	83	61	592	248	32
Aircraft and Parts	2,214	218	24	389	57	5	602	39	9	804	76	4	274	39	2	145	7	4
ailroad Equipment	1,060	142	365	403	43	189	415	70	158	136	8	–	40	3	3	66	18	15
Fabricated Metal Products	5,178	1,202	1,304	1,755	320	539	1,526	375	621	771	46	35	980	206	92	146	55	17
Shipbuilding, Ordnance, Misc.	12,471	2,041	3,225	3,616	729	772	5,850	962	2,042	1,052	75	30	433	90	22	1,520	185	359
Precision Mechanism	1,404	191	144	495	23	46	145	25	95	309	42	–	369	97	3	86	4	–
Total	56,011	12,111	12,063	17,784	4,410	4,034	19,590	4,105	6,459	8,910	1,581	360	5,969	1,185	540	3,758	830	670
BY GEOGRAPHIC AREA																		
Boston	3,717	684	900	1,164	251	306	1,297	235	422	602	66	35	433	101	47	201	31	90
Bridgeport – Hartford	2,214	306	315	417	67	132	593	84	101	777	81	51	351	62	25	76	6	6
New England	1,382	369	472	430	170	151	515	87	258	102	10	5	262	68	34	73	34	24
New York – Newark	3,905	949	715	1,005	245	237	1,437	380	350	521	79	25	675	148	59	267	97	44
Buffalo – Rochester	1,810	342	349	411	90	73	648	120	214	364	57	45	240	48	17	147	27	–
Philadelphia	2,562	629	719	872	266	262	1,059	270	294	60	16	–	183	32	4	388	45	159
Pittsburgh – Wheeling	1,413	352	440	556	154	132	707	163	300	22	–	–	119	31	4	9	4	4
Middle Atlantic	5,387	906	1,812	1,950	295	677	2,224	390	1,051	719	108	29	462	113	45	32	–	10
Baltimore	356	77	50	41	12	3	255	44	41	9	3	3	36	9	3	15	9	–
Southern	4,643	1,043	676	1,517	447	107	1,741	161	490	707	73	17	312	22	17	366	40	45
Cleveland – Youngstown	3,499	645	680	1,344	309	297	1,316	183	315	359	41	20	354	61	44	126	51	4
Cincinnati – Dayton	1,231	308	196	357	77	85	270	42	68	375	138	5	174	35	27	55	16	11
Detroit – Toledo	3,697	1,028	362	829	244	144	492	155	86	1,315	342	55	267	69	47	794	218	28
Milwaukee	1,985	329	596	715	130	208	753	81	341	190	28	4	225	46	25	102	44	18
Chicago	2,539	687	314	1,047	337	96	723	193	167	219	32	–	344	85	6	206	40	45
Indianapolis	498	102	12	76	31	2	76	28	8	250	34	–	39	6	2	55	3	–
Midwestern	9,362	1,900	1,876	3,377	808	598	3,080	597	1,041	1,432	218	18	860	152	93	613	125	126
Minneapolis – St. Paul	262	86	23	89	41	7	90	27	14	25	7	–	56	11	–	2	–	2
St. Louis – Kansas	902	187	176	186	37	33	307	37	99	219	66	7	153	29	26	37	18	11
Central and Mountain	1,767	504	539	545	148	234	663	197	271	376	111	11	93	26	4	90	22	19
Houston	133	16	38	51	8	8	52	8	22	7	–	–	15	–	8	8	–	–
Southwestern	1,059	242	447	280	85	133	607	121	266	73	24	24	74	12	–	25	–	24
San Francisco – Oakland	418	129	142	103	39	26	225	58	116	45	32	–	32	–	–	13	–	–
Los Angeles	726	151	115	209	58	39	260	80	67	106	3	6	122	10	3	29	–	–
Pacific	544	140	99	211	61	44	200	64	55	36	6	–	68	9	–	29	–	–
Total	56,011	12,111	12,063	17,784	4,410	4,034	19,590	4,105	6,459	8,910	1,581	360	5,969	1,185	540	3758	830	670

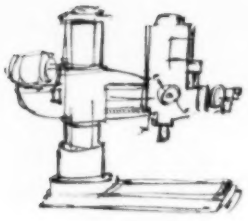
BROACHING MACHINES



(Standard Commodity Code: 3412 00) Includes horizontal internal and surface types (3412 10); vertical internal and surface types (3412 20 & 30); rotary surface and all other types (3412 40 & 90)

12,891 machines—31% at least 10 years old; 14% over 20 years old

	TOTAL BROACHING MACHINES			HORIZONTAL INTERNAL			HORIZONTAL SURFACE			VERTICAL INTERNAL			VERTICAL SURFACE			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	650	173	124	301	69	90	48	7	–	239	76	31	59	21	–	3	–	3
Construction, Mining, Oil Well	334	97	64	224	60	50	27	7	–	43	20	7	23	10	–	17	–	7
Metalworking Machinery	774	195	175	521	138	136	60	8	13	103	18	23	55	18	–	35	13	3
Special-Industry Machinery	719	194	266	420	88	210	66	28	11	144	50	32	39	22	6	50	6	6
General Industrial Equipment	1,046	286	191	639	209	125	84	4	–	242	55	37	48	7	18	33	11	11
Office and Store Machines	158	28	20	53	24	16	–	–	–	24	–	–	77	4	–	4	–	4
Domestic and Service Equip.	398	95	48	150	55	23	20	8	–	66	5	10	159	27	15	3	–	–
Electrical Equipment	759	114	86	237	31	34	52	5	17	204	36	7	183	21	14	83	21	14
Misc. Machine Parts, Jobbing	366	100	55	220	73	55	37	–	–	27	9	–	82	18	–	–	–	–
Motor Vehicles	2,608	1,101	345	668	262	187	138	62	9	386	147	67	1,043	424	72	373	206	10
Aircraft and Parts	346	35	7	110	16	5	34	–	–	57	4	–	138	11	–	7	2	2
Railroad Equipment	82	10	18	40	5	18	–	–	–	10	–	–	32	5	–	–	–	–
Fabricated Metal Products	2,470	511	150	450	138	77	208	137	8	723	84	51	776	55	–	313	97	14
Shipbuilding, Ordnance, Misc.	1,604	365	105	482	72	75	111	13	–	113	6	4	787	287	17	111	7	9
Precision Mechanisms	577	130	137	114	20	20	34	–	–	210	20	50	144	67	17	75	3	50
Total	12,891	3,434	1,791	4,629	1,262	1,121	919	279	58	2,591	530	320	3,645	997	159	1,107	366	133
BY GEOGRAPHIC AREA																		
Boston	1,069	194	107	426	95	91	46	21	–	212	20	4	316	32	–	69	26	12
Bridgeport – Hartford	464	89	132	165	33	51	20	9	3	113	8	39	138	31	25	28	8	14
New England	224	29	103	171	29	93	–	–	–	29	–	5	19	–	–	5	–	5
New York – Newark	583	145	127	205	46	79	25	–	3	116	15	40	232	84	5	5	–	–
Buffalo – Rochester	367	95	40	130	36	30	23	3	–	20	–	–	144	44	10	50	12	–
Philadelphia	347	108	70	103	28	20	28	8	4	60	16	15	87	41	8	69	15	23
Pittsburgh – Wheeling	96	30	21	44	18	4	–	–	–	4	4	–	35	4	13	13	4	4
Middle Atlantic	647	176	60	312	71	41	57	7	13	83	14	3	174	21	3	21	3	–
Baltimore	27	6	3	15	6	3	–	–	–	12	–	–	–	–	–	–	–	–
Southern	932	146	30	321	79	17	60	6	–	111	28	13	193	33	–	247	–	–
Cleveland – Youngstown	1,345	111	142	337	72	118	96	–	9	422	4	4	470	35	–	20	–	11
Cincinnati – Dayton	357	99	36	102	26	21	18	6	–	13	5	5	101	31	8	123	31	2
Detroit – Toledo	2,048	983	271	488	212	137	100	73	–	354	132	63	834	372	61	272	194	10
Milwaukee	245	53	50	139	32	42	42	–	–	11	7	4	46	14	–	7	–	4
Chicago	491	143	96	202	37	61	32	18	–	96	32	–	135	46	13	26	10	22
Indianapolis	135	47	2	55	25	2	–	–	–	5	–	–	73	20	–	2	2	–
Midwestern	2,354	633	353	961	274	206	247	45	26	674	165	86	345	88	9	127	61	26
Minneapolis – St. Paul	63	23	11	39	16	9	11	2	–	11	5	2	–	–	–	2	–	–
St. Louis – Kansas City	420	180	30	99	29	22	62	56	–	18	11	4	241	84	4	–	–	–
Central and Mountain	364	115	68	154	45	41	30	7	–	136	52	27	33	11	–	11	–	–
Houston	25	9	–	8	–	–	3	–	–	3	3	–	11	6	–	–	–	–
Southwestern	91	31	24	66	31	24	–	–	–	25	–	–	–	–	–	–	–	–
San Francisco – Oakland	31	6	6	6	–	–	6	6	–	19	–	6	–	–	–	–	–	–
Los Angeles	110	31	–	58	22	–	10	3	–	26	6	–	6	–	–	10	–	–
Pacific	56	12	9	23	–	9	3	9	–	18	3	–	12	–	–	–	–	–
Total	12,891	3,434	1,791	4,629	1,262	1,121	919	279	58	2,591	530	370	3,645	997	159	1,107	366	133



DRILLING MACHINES

361,935 machines—41% at least 10 years old; 20% over 20 years old

	TOTAL DRILLING MACHINES			SENSITIVE			UPRIGHT SINGLE SPINDLE			UPRIGHT GANG			RADIAL		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	13,069	3,411	3,647	1,903	460	415	4,678	1,066	1,702	1,125	311	322	2,893	772	727
Construction, Mining, Oil Well	6,516	1,685	1,293	868	167	124	2,465	685	598	367	124	97	2,138	518	361
Metalworking Machinery	20,706	4,476	3,483	4,174	718	562	7,826	1,812	1,388	1,913	356	402	4,761	1,130	803
Special-Industry Machinery	25,717	5,227	7,342	5,150	745	1,546	9,202	1,860	2,771	4,300	723	1,573	3,422	839	795
General Industrial Equipment	19,627	4,496	3,716	3,332	804	672	8,012	1,787	1,516	2,397	499	371	2,764	679	628
Office and Store Machines	12,978	2,353	3,687	6,072	1,123	1,872	2,556	387	619	2,629	562	598	106	20	28
Domestic and Service Equipment	11,923	2,923	2,544	2,447	594	499	4,146	1,147	696	3,324	650	907	718	156	181
Electrical Equipment	39,490	7,145	7,363	9,958	1,286	1,820	14,605	2,720	2,081	8,121	1,876	2,026	2,771	523	614
Misc. Machine Parts, Jobbing	18,310	4,506	2,559	2,601	779	96	8,391	1,887	870	3,682	1,081	925	1,713	531	357
Motor Vehicles and Parts	33,079	8,412	12,217	4,444	673	2,468	8,106	1,604	3,641	10,621	3,082	3,866	1,882	403	622
Aircraft and Parts	11,135	1,646	289	3,501	545	32	3,202	503	96	1,634	242	73	1,159	117	42
Railroad Equipment	2,981	650	787	561	116	88	634	169	259	583	116	88	956	214	297
Fabricated Metal Products	60,374	17,463	13,953	13,013	2,453	1,356	45,405	10,106	7,259	7,312	1,590	1,753	5,378	1,399	1,561
Shipbuilding, Ordnance, Misc.	41,175	8,123	6,874	13,733	2,890	821	12,839	2,179	3,172	3,090	741	599	6,029	1,331	1,320
Precision Mechanisms	24,855	4,740	3,086	5,007	620	566	12,163	2,154	1,239	5,178	1,340	1,031	661	195	124
Total	361,935	77,256	72,890	76,764	13,973	12,937	144,230	30,066	27,907	56,276	13,295	14,633	37,353	8,847	8,460
BY GEOGRAPHIC AREA															
Boston	25,563	4,848	6,124	5,735	760	1,270	9,283	1,837	2,166	4,193	770	1,529	2,417	478	510
Bridgeport – Hartford	19,348	3,024	4,298	3,942	393	410	8,280	1,399	1,813	3,475	690	1,060	966	219	152
New England	10,075	1,841	3,734	3,106	454	1,302	3,456	735	1,218	1,940	258	717	1,089	326	292
New York – Newark	31,233	6,909	3,628	7,386	1,273	730	13,171	3,078	1,318	4,886	1,501	554	2,969	589	518
Buffalo – Rochester	10,861	2,552	1,817	1,764	354	414	3,631	698	451	2,788	858	487	945	261	251
Philadelphia	14,533	3,056	2,881	2,222	361	446	6,911	1,217	1,280	2,475	755	537	1,678	467	504
Pittsburgh – Wheeling	4,001	954	1,358	1,261	234	573	1,264	340	348	221	69	53	955	260	362
Middle Atlantic	25,499	4,687	5,468	7,349	761	1,228	8,532	1,847	1,941	2,844	469	575	3,548	857	1,049
Baltimore	1,344	406	104	290	33	9	698	251	44	124	62	27	107	44	12
Southern	23,778	7,209	1,467	10,772	3,424	270	6,709	2,001	636	898	271	99	2,713	810	332
Cleveland – Youngstown	16,101	3,375	4,231	3,061	422	488	6,001	1,523	1,936	2,990	641	965	2,162	391	460
Cincinnati – Dayton	6,722	1,288	1,917	2,059	309	784	1,417	296	291	1,662	327	433	790	166	148
Detroit – Toledo	27,871	7,196	9,687	4,263	707	2,235	7,351	1,413	2,621	8,561	2,461	3,232	1,597	368	471
Milwaukee	7,611	1,756	1,567	1,084	141	130	3,052	705	715	881	290	185	1,331	316	233
Chicago	27,585	6,382	3,706	3,607	896	193	12,910	3,021	1,577	5,510	1,115	1,152	2,189	649	354
Indianapolis	2,261	706	142	362	120	5	507	133	20	763	276	95	184	60	6
Midwestern	64,326	12,608	13,582	10,251	1,505	1,577	30,411	6,114	6,823	7,197	1,593	1,441	7,661	1,488	1,867
Minneapolis – St. Paul	2,719	627	392	231	30	–	1,788	420	293	161	32	45	251	95	36
St. Louis – Kansas City	8,832	1,585	3,107	1,059	150	577	2,990	394	759	2,515	504	1,195	351	69	73
Central and Mountain	9,497	2,100	2,047	2,548	520	419	3,850	742	749	635	171	122	1,337	382	449
Houston	762	227	134	75	8	6	378	129	72	53	25	3	158	47	50
Southwestern	5,732	1,159	556	702	218	36	3,688	629	351	315	36	12	650	183	133
San Francisco – Oakland	3,281	682	411	1,043	187	6	1,349	283	232	206	45	77	303	90	90
Los Angeles	7,831	1,285	311	1,778	392	22	3,969	546	183	758	48	29	642	138	55
Pacific	4,569	803	171	794	321	7	2,634	305	70	225	51	9	400	94	53
Total	361,935	77,256	72,840	76,764	13,973	12,937	144,230	30,066	27,907	56,276	13,295	14,633	37,353	8,847	8,460

(Standard Commodity Code: 3413 00) Includes sensitive, upright single spindle, and gang (3413 50 & 60); radial (3413 20); multiple spindle cluster, adjustable and fixed center (3413 90); unit head and way (3413 70); deep hole drills (3413 10); all other miscellaneous types (3413 60 & 90)

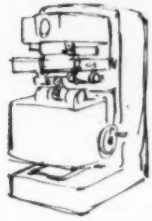
	MULTIPLE SPINDLE CLUSTER ADJ. & FIXED CENTER			UNIT HEAD AND WAY TYPE MULTI-SPINDLE			DEEP-HOLE DRILLS			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY												
Agricultural Machinery	1,100	377	235	429	183	111	104	48	14	837	194	121
Construction, Mining, Oil Well	227	84	40	120	27	3	60	17	7	271	63	63
Metalworking Machinery	655	181	123	471	123	105	168	48	45	738	108	55
Special-Industry Machinery	1,656	673	425	326	83	44	55	6	–	1,606	298	188
General Industrial Equipment	1,464	400	242	297	70	15	139	70	4	1,222	187	268
Office and Store Machines	716	167	285	480	33	216	8	4	–	411	57	69
Domestic and Service Equipment	387	90	102	260	53	32	48	8	23	593	225	104
Electrical Equipment	1,069	170	193	785	226	85	193	35	67	1,988	309	475
Misc. Machine Parts, Jobbing	760	110	137	624	82	55	55	18	–	284	18	119
Motor Vehicles and Parts	2,259	709	507	2,221	589	556	159	69	10	3,387	1,203	547
Aircraft and Parts	843	115	18	159	15	18	143	25	5	494	83	5
Railroad Equipment	93	8	32	27	5	–	15	2	3	110	18	20
Fabricated Metal Products	3,343	741	744	1,461	255	184	281	88	14	4,181	831	1,082
Shipbuilding, Ordnance, Misc.	1,218	215	280	1,227	454	80	1,273	126	365	1,766	167	267
Precision Mechanisms	1,075	378	80	224	1	–	71	–	34	476	52	12
Total	16,865	4,418	3,413	9,311	2,200	1,504	2,772	564	591	18,364	3,893	3,395
BY GEOGRAPHIC AREA												
Boston	1,492	514	295	821	188	115	462	66	35	1,160	235	204
Bridgeport – Hartford	1,320	141	126	252	73	39	371	11	279	742	96	419
New England	233	53	78	112	–	34	19	–	15	160	15	78
New York – Newark	1,357	202	326	393	74	98	68	25	–	1,003	167	84
Buffalo – Rochester	544	184	67	324	50	107	10	–	–	835	147	40
Philadelphia	345	83	103	167	36	12	40	24	4	695	119	195
Pittsburgh – Wheeling	84	9	9	26	–	–	–	–	–	190	62	13
Middle Atlantic	1,045	316	156	271	31	10	192	69	24	1,718	337	485
Baltimore	86	6	6	6	–	6	–	–	–	33	–	–
Southern	909	275	90	448	118	6	412	90	11	917	220	23
Cleveland – Youngstown	932	248	260	425	69	28	90	20	4	440	61	90
Cincinnati – Dayton	351	66	159	105	22	28	43	10	18	295	82	56
Detroit – Toledo	1,694	509	364	1,406	552	190	142	67	5	2,857	1,119	569
Milwaukee	313	46	102	362	194	51	113	18	74	475	46	77
Chicago	727	231	77	440	129	51	72	45	–	2,130	296	302
Indianapolis	153	44	8	48	20	3	41	6	3	203	41	2
Midwestern	3,830	1,111	903	2,037	302	414	378	40	85	2,561	455	472
Minneapolis – St. Paul	68	23	5	154	25	2	9	–	–	57	2	11
St. Louis – Kansas City	486	142	77	1,014	235	254	37	–	–	380	91	172
Central and Mountain	480	122	171	160	41	33	96	48	22	391	74	82
Houston	17	6	–	–	–	–	42	6	–	39	6	3
Southwestern	97	24	–	24	12	–	36	–	12	220	48	12
San Francisco – Oakland	39	6	6	45	–	–	58	–	–	238	71	–
Los Angeles	202	42	22	148	19	–	32	16	–	302	87	–
Pacific	61	15	3	123	–	23	9	3	–	323	14	6
Total	16,865	4,418	3,413	9,311	2,200	1,504	2,772	564	591	18,364	3,893	3,395

GEAR CUTTING & FINISHING MACHINES

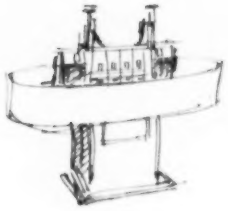
44,216 machines—50% at least 10 years old; 23% over 20 years old

	TOTAL GEAR CUTTING AND FINISHING MACHINES			HOBBING MACHINES			GEAR SHAPERS			CUTTERS FORM-MILLING TYPE			BEVEL GEAR CUTTERS (NOT PLANER)			PLANER TYPE CUTTERS		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	59TAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	2,962	914	647	1,602	519	343	429	135	142	111	62	21	232	80	55	55	–	31
Construction, Mining, Oil Well	1,342	357	334	478	137	87	261	67	67	574	94	137	70	7	20	53	33	13
Metalworking Machinery	4,822	1,092	1,324	1,516	397	442	984	256	226	580	133	346	404	68	136	143	15	60
Special-Industry Machinery	3,932	1,044	1,955	1,231	320	618	1,036	293	386	1,248	337	784	248	66	116	28	–	17
General Industrial Equip.	7,025	2,023	1,605	2,496	782	503	1,417	360	235	705	198	393	1,167	327	294	165	40	95
Office and Store Machines	1,001	260	427	611	183	240	138	41	20	187	16	151	45	16	8	–	–	–
Domestic and Service Equip.	722	219	102	366	82	58	206	84	28	10	10		56	3	10	10	5	–
Electrical Equipment	1,922	211	424	1,013	99	301	426	40	50	150	33	57	86	5	9	–	–	–
Misc. Machine Parts, Jobbing	696	210	284	256	64	73	211	82	73	156	46	101	9	9	–	64	9	37
Motor Vehicles and Parts	8,689	3,414	1,956	2,805	1,083	667	1,920	523	792	80	14	56	1,689	737	279	–	–	–
Aircraft and Parts	1,716	140	12	312	27	7	570	51	5	16	–	–	140	11	–	21	5	–
Railroad Equipment	133	7	72	65	7	28	27	–	17	20	–	17	5	–	2	3	–	3
Fabricated Metal Products	1,956	662	483	590	164	97	772	396	148	222	63	101	12	–	6	13	–	–
Shipbuilding, Ordnance, Misc.	3,132	600	404	941	248	130	738	107	92	172	102	85	365	36	8	74	6	30
Precision Mechanisms	3,966	772	255	1,585	434	49	242	35	4	1,553	214	184	93	25	6	3	–	3
Total	44,216	11,925	10,284	15,867	4,546	3,643	9,319	2,470	2,285	5,784	1,322	2,433	4,621	1,390	949	632	113	289
BY GEOGRAPHIC AREA																		
Boston	3,472	923	1,134	1,239	263	235	854	354	231	661	169	446	205	51	102	94	15	62
Bridgeport–Hartford	1,602	250	205	475	104	126	461	62	28	73	25	25	98	17	3	21	8	11
New England	2,203	664	943	510	68	207	630	248	204	690	244	428	101	10	53	15	–	10
New York–Newark	3,524	695	525	861	335	177	635	64	94	997	109	154	107	20	17	35	–	20
Buffalo–Rochester	1,013	250	219	307	60	67	130	40	40	87	20	67	311	107	12	7	–	3
Philadelphia	882	139	285	381	71	83	202	52	75	139	8	91	40	*4	16	4	–	4
Pittsburgh–Wheeling	439	105	198	238	66	115	18	9	4	101	4	79	22	9	–	–	–	–
Middle Atlantic	2,383	455	556	770	191	174	508	115	90	312	56	224	423	42	10	63	14	20
Baltimore	80	12	33	24		6	41	6	24	6	3	3	9	3		–	–	–
Southern	2,763	757	277	925	275	152	650	169	51	211	172	28	395	64	34	50	23	6
Cleveland–Youngstown	2,165	355	686	786	114	260	549	102	163	199	49	81	182	20	66	45	12	24
Cincinnati–Dayton	918	195	282	378	90	89	150	37	26	155	14	118	47	13	14	31	2	14
Detroit–Toledo	7,604	3,140	1,564	2,483	1,021	529	1,723	483	645	85	10	52	1,214	688	201	–	–	–
Milwaukee	1,181	334	269	542	169	102	183	42	56	141	49	77	66	7	11	4	–	–
Chicago	2,090	413	380	900	219	244	276	58	26	699	66	71	71	26	13	13	–	13
Indianapolis	725	284	4	257	119	2	186	83	2	2	2	–	47	4	–	14	2	–
Midwestern	7,313	1,865	1,769	3,077	842	742	1,417	374	321	516	155	234	1,978	220	329	181	34	61
Minneapolis–St. Paul	356	100	57	129	32	18	77	32	7	30	9	18	64	18	7	2	–	2
St. Louis–Kansas City	445	120	147	274	102	62	113	7	66	7	–	7	11	–	4	7	–	–
Central and Mountain	1,578	484	301	865	270	151	236	74	52	41	15	22	156	48	42	4	–	–
Houston	184	61	64	39	17	3	9	–	3	130	44	58	3	–	–	–	–	–
Southwestern	243	97	73	97	61	–	24	–	–	109	36	73	–	–	–	–	–	–
San Francisco–Oakland	244	32	147	84	–	45	64	–	52	52	19	32	32	13	6	6	–	6
Los Angeles	298	102	58	83	22	13	116	39	13	61	26	22	13	6	–	13	3	10
Pacific	511	73	108	123	35	41	67	20	12	260	16	23	26	–	9	23	–	23
Total	44,216	11,925	10,284	15,867	4,546	3,643	9,319	2,470	2,285	5,784	1,322	2,433	4,621	1,390	949	632	113	289

(Standard Commodity Code: 3414 00) Includes gear hobbing machines (3414 10) gear shapers (3414 20); form-milling type gear cutters (3414 30); bevel gear cutters (not planer type) (3414 40); planer type gear cutters (3414 35); gear grinders, shavers, also burnishing, lapping, chamfering, tooth pointing, and tooth rounding machines (3414 50); miscellaneous machines and other types not elsewhere listed (3414 59). Gear checking machines total 4341 with 32% at least 10 years old; 12% over 20 years old. These are not included in the total for above equipment



	GEAR GRINDERS			GEAR SHAVERS			BURNISHING AND LAPPING			CHAMFERING TOOTH POINTING TOOTH ROUNDING			OTHER			GEAR CHECKING MACHINES (NOT INCLUDED IN TOTAL)		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	3	–	–	163	21	–	59	21	–	142	38	17	166	38	38	464	142	66
Construction, Mining, Oil Well	–	–	–	10	3	–	23	3		50	13	10	23	–	–	77	3	3
Metalworking Machinery	399	85	13	181	20	3	216	48	23	176	45	50	223	25	25	974	208	138
Special-Industry Machinery	11	6	6	6	–	–	28	11	–	17	–	6	77	11	22	144	33	50
General Industrial Equipment	125	26	18	264	40	4	378	147	26	202	55	22	106	48	15	763	139	110
Office and Store Machines	–	–	–	4	–	–	16	4	8	–	–	–	–	–	–	4	–	–
Domestic and Service Equipment	3	3	–	23	8	3	20	8	3	15	13	–	13	3	–	41	18	–
Electrical Equipment	43	5	5	36	–	–	29	22	–	12	–	–	127	7	2	306	12	7
Misc. Machine Parts, Jobbing	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9	–	–
Motor Vehicles and Parts	130	55	6	809	282	13	659	368	80	550	324	52	47	28	11	481	103	102
Aircraft and Parts	455	27	–	114	–	–	133	19	–	25	–	–	–	–	–	358	18	2
Railroad Equipment	5	–	5	5	–	–	–	–	–	–	–	–	3	–	–	22	2	2
Fabricated Metal Products	75	–	8	98	6	24	8	8	–	26	13	–	140	12	99	65	–	–
Shipbuilding, Ordnance, Misc.	480	46	16	137	23	4	94	5	3	44	–	–	87	27	36	424	156	13
Precision Mechanisms	–	–	–	26	–	–	406	61	–	5	–	–	53	3	9	209	11	–
Total	1,729	253	77	1,866	403	51	2,069	725	143	1,264	501	157	1,065	202	257	4,341	845	493
BY GEOGRAPHIC AREA																		
Boston	98	15	8	76	4	4	66	12	8	49	16	11	110	24	27	213	14	43
Bridgeport – Hartford	316	8	3	42	6	6	45	17	–	34	3	3	37	–	–	279	18	8
New England	19	5	5	58	15	–	53	20	13	44	19	13	83	35	10	289	57	77
New York – Newark	305	49	19	98	–	–	607	103	5	20	5	–	59	10	39	349	24	10
Buffalo – Rochester	10	–	–	17	–	–	60	13	10	17	7	–	67	3	20	214	25	32
Philadelphia	16	–	–	36	4	–	20	8	4	12	–	4	32	12	8	64	4	4
Pittsburgh – Wheeling	29	9	–	18	4	–	4	4	–	–	–	–	9	–	–	40	13	–
Middle Atlantic	30	10	–	50	7	–	133	7	–	35	3	7	59	10	31	316	68	19
Baltimore	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24	9	3
Southern	301	20	–	69	17	–	185	6	–	44	–	–	33	11	6	290	135	–
Cleveland – Youngstown	79	20	8	93	4	16	74	8	12	79	18	23	79	8	33	244	25	25
Cincinnati – Dayton	53	18	7	23	3	–	39	8	2	34	8	10	8	2	2	109	24	6
Detroit – Toledo	203	54	5	761	249	16	570	325	65	466	276	35	99	34	16	492	102	91
Milwaukee	11	7	–	63	7	–	108	39	12	42	14	11	21	–	–	123	24	7
Chicago	41	6	–	6	–	–	45	32	–	–	–	–	39	6	13	304	69	13
Indianapolis	69	6	–	59	23	–	44	14	–	47	31	–	–	–	–	16	8	–
Midwestern	121	21	22	305	49	9	267	92	12	264	65	21	187	13	18	614	119	103
Minneapolis – St. Paul	11	5	–	9	–	–	9	–	–	16	2	5	9	2	–	54	16	2
St. Louis – Kansas City	4	–	–	7	–	–	4	–	–	7	4	4	11	7	4	15	–	–
Central and Mountain	6	–	–	70	11	–	30	11	–	39	30	4	111	25	30	225	85	44
Houston	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Southwestern	1	–	–	–	–	–	–	–	–	–	–	–	12	–	–	12	–	–
San Francisco – Oakland	–	–	–	–	–	–	–	–	–	6	–	6	–	–	–	6	6	–
Los Angeles	–	–	–	3	–	–	6	6	–	3	–	–	–	–	–	22	–	–
Pacific	3	–	–	3	–	–	–	–	–	6	–	–	–	–	–	29	–	6
Total	1,729	253	177	1,866	403	51	2,069	725	143	1,264	501	157	1,065	202	257	4,341	845	493

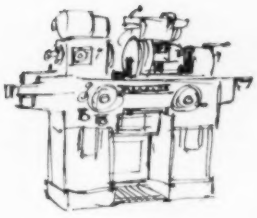


GRINDING MACHINES

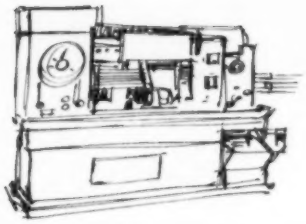
362,776 machines—37% at least 10 years old; 15% over 20 years old

	TOTAL GRINDING MACHINES			EXTERNAL CYL. PLAIN & UNIV.			INTERNAL CYLINDRICAL			EXTERNAL CENTERLESS			INTERNAL CENTERLESS			SURFACE ROTARY TABLE TYPE		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	9,530	2,260	2,359	1,145	228	194	394	87	66	215	45	45	16	4	–	311	69	55
Construction, Mining, Oil Well	6,826	1,842	1,283	753	170	124	421	127	110	137	47	7	8	3	–	220	53	43
Metalworking Machinery	37,790	7,709	6,244	6,298	1,333	1,373	2,487	610	379	560	113	43	42	12	6	1,905	371	274
Special-Industry Machinery	24,807	5,768	5,729	2,876	552	872	756	166	171	337	66	22	5	–	3	905	221	144
General Industrial Equipment	18,748	4,281	2,513	2,521	536	415	1,318	283	154	327	51	15	24	4	6	1,006	264	121
Office and Store Machines	7,243	2,052	1,354	863	179	175	260	69	33	191	69	24	3	1	–	199	61	52
Domestic and Service Equip't	9,939	2,288	1,716	1,225	254	211	372	103	37	700	151	30	8	2	–	482	154	75
Electrical Equipment	30,092	5,007	4,601	3,343	691	535	1,010	199	142	507	111	50	20	3	2	1,203	201	231
Misc. Machine Parts, Jobbing	26,062	7,377	2,100	3,197	870	412	2,217	311	238	3,811	1,273	165	321	150	12	953	229	73
Motor Vehicles and	33,251	9,001	8,585	6,962	1,712	1,914	2,249	546	483	2,691	767	434	334	121	21	1,488	384	297
Aircraft and Parts	14,820	2,173	159	2,096	276	39	1,363	184	18	704	225	2	18	3	–	596	129	7
Railroad Equipment	3,820	864	1,007	312	48	58	226	101	28	178	23	10	16	4	1	85	17	13
Fabricated Metal Products	70,619	16,826	8,826	4,840	1,365	597	1,667	357	142	1,860	426	61	17	1	2	2,615	634	239
Shipbuilding, Ordnance, Misc.	51,877	9,581	7,761	4,208	1,006	603	2,419	229	178	624	59	51	21	6	2	2,066	332	368
Precision Mechanisms	18,152	3,832	1,457	1,945	360	224	318	124	28	276	3	3	12	–	–	445	49	48
Total	362,776	80,862	55,694	42,586	9,603	7,646	17,477	3,496	2,207	13,118	3,429	962	865	314	57	14,479	3,188	2,040
BY GEOGRAPHIC AREA																		
Boston	26,496	5,323	5,094	3,890	774	896	1,156	189	177	533	157	47	20	3	2	1,266	290	188
Bridgeport-Hartford	21,180	4,226	4,059	2,878	434	496	1,586	248	218	755	162	87	36	14	2	969	157	135
New England	14,837	2,635	4,008	1,797	408	459	580	107	155	238	53	10	10	–	–	525	78	151
New York-Newark	26,828	7,126	2,761	2,673	635	375	1,785	546	148	2,056	706	113	243	62	10	1,578	340	202
Buffalo-Rochester	8,560	2,251	971	1,123	357	137	374	114	43	374	77	23	15	3	3	331	57	47
Philadelphia	15,330	3,312	2,527	1,110	357	199	547	79	75	377	40	36	28	14	–	401	75	54
Pittsburgh-Wheeling	4,612	1,325	836	328	119	97	163	44	31	97	22	9	7	–	2	115	53	9
Middle Atlantic	26,820	5,213	4,776	2,436	601	306	938	172	102	586	146	10	30	8	3	1,161	309	163
Baltimore	1,486	354	120	121	24	18	30	9	9	18	6	–	–	–	–	124	18	27
Southern	28,517	8,748	1,292	2,685	939	56	1,331	170	39	372	28	–	36	9	11	764	169	28
Cleveland-Youngstown	21,370	3,560	2,247	3,133	590	359	956	164	154	1,673	413	40	35	14	–	875	130	134
Cincinnati-Dayton	6,993	1,294	1,287	863	138	187	377	93	35	319	72	13	15	3	–	335	61	35
Detroit-Toledo	32,932	7,068	6,718	5,899	1,490	1,544	2,369	449	339	2,235	720	318	221	108	16	1,205	332	223
Milwaukee	7,621	1,554	1,316	836	246	148	275	39	39	134	53	–	18	9	2	436	81	35
Chicago	21,394	5,465	2,361	2,529	604	347	794	149	109	557	58	19	39	10	–	874	212	141
Indianapolis	2,614	774	59	429	133	6	243	44	6	119	31	2	6	–	–	137	39	2
Midwestern	55,849	11,614	10,357	6,910	1,177	1,403	2,639	523	285	1,786	535	121	72	29	4	2,369	557	281
Minneapolis-St. Paul	2,683	634	397	186	59	16	95	25	5	56	2	2	8	–	–	93	14	9
St. Louis-Kansas City	6,059	1,471	1,379	686	88	245	237	55	53	360	66	84	–	–	–	170	14	22
Central and Mountain	8,292	2,096	1,404	762	219	116	322	104	41	212	41	19	10	3	–	212	63	37
Houston	2,049	644	230	167	42	11	171	55	19	56	25	3	1	–	–	66	14	17
Southwestern	6,148	1,332	703	397	85	97	157	24	61	25	–	–	–	–	–	243	61	61
San Francisco-Oakland	2,158	553	291	219	71	26	71	45	–	13	–	–	–	–	–	39	6	13
Los Angeles	6,809	1,154	294	327	77	18	161	39	39	135	10	6	12	5	2	135	29	13
Pacific	3,139	934	187	202	36	44	120	20	23	30	6	–	3	–	–	56	9	3
Total	362,776	80,862	55,694	42,586	9,603	7,646	17,477	3,496	2,207	13,118	3,429	962	865	314	57	14,479	3,188	2,040

(Standard Commodity Code: 3415 00) Includes external cylindrical, plain, & universal (3415 10 & 20); internal cylindrical, external centerless, & internal centerless (3415 30); rotary table type surface, reciprocating type surface (3415 40); horizontal and vertical disk type (3415 80); tool and cutter grinders (3415 60 & 70); bench, floorstand, and snag types (3415 80); abrasive belt machines (not polishing types) and all others not listed elsewhere (3415 90). Thread grinders will be found in the Threading table.



	SURFACE RECIPROCATING TYPE			DISK HORIZONTAL AND VERTICAL			TOOL AND CUTTER			BENCH, FLOORSTAND, AND SNAG			ABRASIVE BELT (NOT POLISHING)			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	381	87	93	301	104	66	2,187	481	322	4,203	1,093	1,484	156	14	3	221	48	31
Construction, Mining, Oil Well	257	40	50	154	63	53	1,844	401	254	2,632	852	625	174	30	–	224	57	17
Metalworking Machinery	6,707	1,516	675	1,074	216	331	7,038	1,310	1,375	7,570	1,586	1,423	1,165	143	68	2,944	499	597
Special-Industry Machinery	1,904	403	293	1,270	397	237	3,787	883	662	10,505	2,594	2,931	1,231	221	138	1,231	265	254
General Industrial Equipment	1,050	195	139	532	191	110	3,509	888	415	6,279	1,582	1,046	646	70	15	936	217	77
Office and Store Machines	1,502	761	159	212	69	49	757	163	232	2,564	615	480	513	45	85	179	20	65
Domestic and Service Equip.	1,284	316	135	491	147	104	2,774	587	543	1,884	487	365	236	32	10	483	55	206
Electrical Equipment	4,415	767	472	1,986	259	443	5,583	946	918	8,387	1,326	1,403	1,711	209	54	1,927	295	351
Misc. Machine Parts, Jobbing	1,814	330	110	1,722	456	27	2,977	568	321	4,250	1,310	385	989	101	64	3,811	1,777	293
Motor Vehicles and Parts	2,413	592	587	1,106	366	291	9,985	2,416	3,026	2,642	716	784	89	6	3	3,292	1,375	745
Aircraft and Parts	1,131	96	4	1,460	131	11	2,381	398	44	3,844	641	28	579	48	2	648	42	4
Railroad Equipment	342	61	22	156	40	55	1,051	206	134	1,190	287	606	118	37	25	146	40	55
Fabricated Metal Products	9,628	2,301	1,042	2,175	607	361	10,819	2,129	1,589	27,162	7,570	3,747	4,921	808	170	4,915	608	876
Shipbuilding, Ordnance, Misc.	3,325	457	441	2,006	429	388	9,024	1,841	1,598	18,669	4,334	3,547	721	66	24	8,594	822	561
Precision Mechanisms	2,524	542	198	483	177	101	3,063	507	215	6,754	1,612	596	1,672	351	33	660	84	11
Total	38,677	8,464	4,420	15,128	3,654	2,627	66,779	13,724	11,648	108,535	26,605	19,450	14,921	2,181	694	30,211	6,204	3,943
BY GEOGRAPHIC AREA																		
Boston	4,014	860	564	1,051	204	353	4,147	886	958	7,297	1,462	1,405	1,258	222	37	1,764	276	337
Bridgeport-Hartford	2,582	542	289	441	98	143	3,532	837	692	3,706	582	1,109	415	48	–	4,280	1,104	888
New England	1,536	292	248	199	49	49	2,095	515	355	5,987	914	2,319	626	83	34	1,244	136	228
New York-Newark	3,387	784	255	1,114	449	148	5,428	872	720	5,185	1,297	716	1,549	297	30	1,830	113	44
Buffalo-Rochester	1,273	394	87	261	57	47	2,275	671	267	1,677	384	237	319	43	3	538	94	77
Philadelphia	1,497	222	167	989	202	111	2,465	631	425	5,625	1,116	1,108	618	135	36	1,673	441	306
Pittsburgh-Wheeling	666	137	79	260	26	93	944	249	172	1,314	481	234	154	22	–	564	172	110
Middle Atlantic	3,244	628	337	1,270	239	337	4,489	766	799	9,455	1,797	2,310	1,619	287	97	1,592	260	312
Baltimore	98	33	9	110	77	6	216	66	21	574	274	27	192	27	–	3	–	3
Southern	2,210	602	62	763	236	11	4,934	1,200	287	12,457	4,882	781	888	68	–	2,077	541	17
Cleveland-Youngstown	2,462	309	330	1,832	81	110	3,930	749	406	4,540	904	592	603	37	4	1,331	179	116
Cincinnati-Dayton	895	174	95	229	66	53	2,066	325	394	1,499	279	412	195	26	14	700	97	29
Detroit-Toledo	2,639	681	528	811	280	213	7,584	1,659	2,376	3,874	667	688	367	12	1	2,128	670	462
Milwaukee	669	144	77	384	81	116	1,725	324	268	2,626	514	567	215	21	4	303	42	60
Chicago	3,112	819	174	926	302	180	3,707	729	373	6,181	2,122	743	1,162	203	64	1,513	257	231
Indianapolis	220	59	6	61	14	3	905	265	20	335	154	8	44	5	–	115	30	6
Midwestern	5,699	1,320	848	1,979	666	433	9,414	1,328	2,097	19,658	4,401	4,114	2,294	437	198	3,027	641	573
Minneapolis-St. Paul	149	34	11	90	25	11	315	57	16	1,409	394	329	178	50	2	104	14	–
St. Louis-Kansas City	798	186	150	270	95	58	1,757	427	438	1,358	496	238	164	7	–	259	37	69
Central and Mountain	495	104	63	445	137	89	1,404	412	293	3,517	902	716	322	26	–	561	85	30
Houston	58	6	3	25	–	–	496	100	33	865	393	144	38	9	–	106	–	–
Southeastern	192	24	–	157	12	12	924	194	109	3,276	908	327	473	24	24	304	–	12
San Francisco-Oakland	193	32	13	135	45	39	348	109	45	895	206	142	219	26	13	26	13	–
Los Angeles	401	55	10	546	128	6	1,085	205	55	3,127	539	83	646	19	–	234	48	22
Pacific	188	23	15	780	85	6	564	122	29	2,498	577	55	463	47	3	235	8	6
Total	38,677	8,464	4,420	15,128	3,654	2,627	66,779	13,724	11,648	108,535	26,605	19,450	14,921	2,181	694	30,211	6,204	3,943

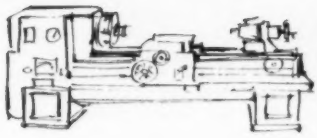


LATHES

396,464 machines—47% at least 10 years old; 25% over 20 years old

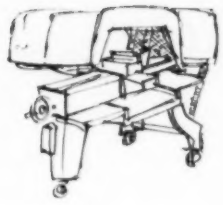
	TOTAL LATHES			BENCH & FLOOR LIGHT DUTY			ENGINE, HEAVY DUTY INCL. TOOLROOM, MFG, AUTOMATIC FORM, GAP			TURRET LATHES RAM TYPE & HAND SCREW			TURRET LATHES SADDLE TYPE		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	9,484	2,266	2,326	464	87	87	2,370	637	841	1,574	266	263	1,169	294	339
Construction, Mining, Oil Well	9,622	2,584	2,117	631	157	134	4,001	1,212	1,289	1,917	544	167	1,884	501	424
Metalworking Machinery	31,282	6,771	7,908	5,216	909	991	14,013	3,341	4,463	4,608	738	828	3,140	761	371
Special-Industry Machinery	30,835	6,723	11,929	4,786	856	1,601	14,026	3,069	6,894	6,216	1,540	1,750	2,230	386	486
General Industrial Equipment	26,621	6,132	6,202	3,428	756	411	7,931	1,967	2,896	6,173	1,233	1,285	3,332	811	484
Office and Store Machines	10,733	1,294	4,627	1,929	265	700	1,563	277	859	912	61	256	49	16	12
Domestic and Service Equipment	10,047	2,313	1,901	1,689	467	274	2,875	716	747	1,861	267	430	487	151	48
Electrical Equipment	41,071	8,609	8,482	11,124	2,291	1,773	11,254	2,260	3,362	5,566	1,273	815	1,974	437	314
Misc. Machine Parts and Jobbing	25,117	6,989	4,102	4,241	1,108	412	8,409	2,721	2,427	4,351	925	641	1,145	284	211
Motor Vehicles and Parts	23,415	6,178	6,869	1,463	330	413	8,618	2,516	2,584	2,480	513	795	622	137	203
Aircraft and Parts	8,783	1,359	[illegible]290	959	104	18	3,140	542	131	2,214	354	60	503	65	41
Railroad Equipment	3,376	626	1,005	221	23	32	1,575	262	715	802	164	129	189	56	35
Fabricated Metal Products	82,502	18,363	23,993	16,504	3,563	3,251	22,540	5,612	8,144	13,436	2,705	4,268	3,834	1,111	591
Shipbuilding, Ordnance, and Misc.	51,048	9,069	10,876	7,296	1,691	1,244	22,707	4,493	6,298	6,011	1,124	1,089	3,444	751	488
Precision Mechanisms	32,528	6,946	6,687	11,409	2,439	2,520	6,176	1,348	1,876	5,706	1,184	862	631	184	8
Total	396,464	86,222	99,334	71,360	15,046	13,861	131,198	30,973	43,526	63,827	12,891	13,638	24,633	5,945	4,055
BY GEOGRAPHIC AREA															
Boston	35,367	6,902	11,714	7,976	1,399	2,340	12,434	2,262	5,310	5,024	900	1,413	1,564	285	235
Bridgeport–Hartford	22,650	3,621	8,772	3,405	388	1,175	6,123	1,163	2,245	2,776	419	1,071	560	146	115
New England	14,020	1,852	6,443	2,638	292	640	5,545	651	3,780	2,464	365	1,055	1,200	209	452
New York–Newark	33,546	9,133	6,002	8,653	2,317	984	9,807	2,973	2,618	5,087	1,235	1,186	1,983	630	138
Buffalo–Rochester	12,479	2,806	3,336	2,713	521	868	3,303	875	808	1,520	284	377	839	281	144
Philadelphia	18,763	3,642	4,313	3,559	512	875	6,709	1,540	2,124	2,696	619	443	991	287	159
Pittsburgh–Wheeling	6,569	1,845	2,037	942	260	298	2,421	714	833	498	128	137	704	172	101
Middle Atlantic	28,776	5,673	8,240	5,595	756	1,317	10,652	2,117	4,574	5,324	1,505	963	1,663	344	274
Baltimore	1,582	255	353	246	29	27	610	110	299	255	36	18	21	12	–
Southern	33,308	8,723	2,789	7,337	2,548	445	11,144	3,398	1,462	3,619	703	186	2,188	725	174
Cleveland–Youngstown	20,502	3,151	5,886	2,005	313	279	6,997	1,258	2,677	5,172	635	1,132	1,733	243	379
Cincinnati–Dayton	7,282	1,381	2,572	952	166	309	2,533	638	744	1,335	209	213	465	72	50
Detroit–Toledo	19,058	4,733	5,663	1,562	230	504	6,682	1,941	1,821	1,928	363	598	483	99	127
Milwaukee	5,839	1,856	2,214	1,492	310	222	2,915	620	901	1,647	359	387	909	203	208
Chicago	30,043	8,336	5,249	6,947	1,859	1,197	7,999	2,585	1,434	6,214	1,305	1,068	964	382	51
Indianapolis	2,666	803	93	323	92	17	955	356	67	563	179	3	62	14	–
Midwestern	57,555	12,325	14,725	7,707	1,619	1,735	18,824	4,064	6,799	10,640	2,313	2,416	5,313	1,057	906
Minneapolis–St. Paul	3,147	399	306	571	95	18	722	129	188	488	64	61	86	27	9
St. Louis–Kansas City	9,548	1,943	2,760	1,023	175	182	2,930	486	1,299	1,015	153	336	421	33	117
Central and Mountain	9,313	2,066	2,086	1,660	368	282	2,871	801	701	1,762	267	267	747	217	145
Houston	2,048	715	229	78	15	11	688	271	133	596	238	66	272	102	11
Southeastern	7,398	1,757	1,743	1,516	363	24	3,698	932	1,562	1,154	194	48	612	242	73
San Francisco–Oakland	3,385	630	728	647	116	45	1,127	270	496	573	161	103	161	39	52
Los Angeles	5,797	1,102	617	1,185	202	35	2,202	475	321	1,114	189	71	438	83	103
Pacific	2,829	571	444	628	101	32	1,307	324	330	363	68	20	254	41	32
Total	396,464	86,222	99,334	71,360	15,046	13,861	131,198	30,973	43,526	63,827	12,891	13,638	24,633	5,945	4,055

(Standard Commodity Code: 3416 00) Includes bench & floor light duty types (3416 10 & 20); heavy duty engine, toolroom, manufacturing, automatic form, and gap types (3416 30); ram and saddle type turret lathes (3416 40), plus hand screw machines; horizontal and vertical automatic chucking, including single and multiple spindle (3416 50); horizontal and vertical automatic between centers chucking, including single and multiple spindle (3416 60); automatic bar-type screw machines, all styles (3416 70); gun and shaft boring lathes (3416 80); all other types, including axle, crankshaft, cartridge trimming, spinning, and relieving (3416 90)



	AUTOMATIC CHUCKING HORIZ AND VERT			AUTOMATIC BETWEEN CENTERS CHUCKING			AUTOMATIC SCREW MACHINES BAR			GUN AND SHAFT BORING			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	1,152	311	97	1,761	477	426	592	114	128	111	28	14	291	52	131
Construction, Mining, Oil Well Equip.	244	73	30	134	30	7	180	37	43	40	17	20	591	13	3
Metalworking Machinery	530	138	98	208	18	30	2,776	710	718	58	–	30	733	156	379
Special-Industry Machinery	822	210	237	88	39	–	2,120	524	613	11	–	11	536	99	337
General Industrial Equipment	1,974	466	297	547	143	73	2,697	620	584	7	–	–	532	136	172
Office and Store Machines	94	12	24	20	4	4	6,154	651	2,772	–	–	–	12	8	–
Domestic and Service Equipment	706	219	125	59	13	5	2,077	394	205	–	–	–	293	86	67
Electrical Equipment	1,527	274	288	82	27	–	8,024	1,688	1,377	34	–	19	1,486	359	534
Misc. Machine Parts, and Jobbing	1,292	403	82	27	–	–	5,386	1,548	256	–	–	–	266	–	73
Motor Vehicles and Parts	4,186	1,163	1,223	555	126	104	4,277	1,002	1,228	–	–	–	1,214	391	339
Aircraft and Parts	720	99	5	285	25	11	772	110	19	4	–	–	186	60	5
Railroad Equipment	129	10	3	13	–	3	337	81	28	12	3	–	98	27	60
Fabricated Metal Products	1,559	198	220	401	88	12	19,764	4,229	4,616	25	17	–	4,439	840	2,891
Shipbuilding, Ordnance, and Misc.	1,792	239	362	1,146	86	40	4,067	478	381	984	44	377	3,601	163	597
Precision Mechanisms	348	20	123	40	34	3	7,390	1,516	1,242	–	–	–	828	221	53
Total	17,075	3,835	3,214	5,366	1,110	718	66,613	13,702	14,210	1,286	109	471	15,106	2,611	5,641
BY GEOGRAPHIC AREA															
Boston	1,103	327	296	114	51	39	5,780	1,496	1,378	151	–	31	1,221	192	672
Bridgeport – Hartford	1,015	220	239	320	11	6	6,664	1,139	2,505	102	3	77	1,685	112	1,339
New England	503	83	202	405	116	52	1,182	117	199	–	–	–	83	19	63
New York – Newark	1,480	250	217	113	5	34	5,944	1,600	687	–	–	–	479	123	138
Buffalo – Rochester	641	194	137	10	–	3	2,531	501	688	7	–	7	915	150	304
Philadelphia	591	151	127	206	40	8	3,419	493	318	12	–	4	580	–	255
Pittsburgh – Wheeling	86	13	31	40	9	26	629	231	71	–	–	–	1,247	318	540
Middle Atlantic	1,053	221	135	226	46	17	3,477	610	593	362	12	121	424	62	246
Baltimore	139	18	3	172	–	–	124	38	6	–	–	–	15	12	–
Southern	766	118	22	519	23	6	4,640	938	263	264	19	103	2,831	201	128
Cleveland – Youngstown	657	130	118	216	24	24	3,421	495	1,167	16	–	8	285	53	102
Cincinnati – Dayton	156	82	10	26	6	2	1,702	166	1,232	13	–	2	100	42	10
Detroit – Toledo	3,026	834	989	442	118	69	3,671	773	1,160	4	1	1	1,260	374	394
Milwaukee	232	70	28	141	99	11	1,351	169	417	25	–	21	127	28	39
Chicago	524	71	64	203	32	–	6,669	1,853	1,297	84	18	6	439	231	132
Indianapolis	178	48	3	9	6	–	546	101	3	5	2	–	25	5	–
Midwestern	3,604	718	312	1,153	223	160	8,080	1,820	1,312	161	30	78	2,073	481	1,007
Minneapolis	57	11	11	14	–	5	742	73	7	–	–	–	462	–	7
St. Louis – Kansas City	641	156	172	62	–	7	3,306	896	578	–	–	–	150	44	69
Central and Mountain	178	56	41	772	201	249	931	78	260	7	14	–	385	74	141
Houston	97	14	–	108	25	–	136	42	8	19	–	–	54	8	–
Southwestern	24	–	–	–	–	–	266	–	–	48	14	12	80	12	24
San Francisco – Oakland	13	6	–	–	–	–	838	19	26	–	–	–	26	19	6
Los Angeles	254	35	59	83	19	–	399	45	29	6	6	–	116	48	19
Pacific	55	9	18	12	6	–	165	19	6	–	–	–	44	3	6
Total	17,075	3,835	3,214	5,366	1,110	718	66,613	13,702	14,210	1,286	109	471	15,106	2,611	5,641

CUTOFF MACHINES

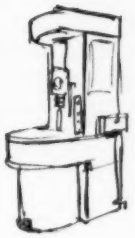


(Standard Commodity Code: 3419 50) Includes all types of straight cutoff and contour sawing machines. The latter are not listed in the total for straight cutoff, but separately. Bandsaw, abrasive disk, hacksaw, rotary hot and cold saws, plus all others of this type (3419 50). Contour sawing and filing (3419 52) total 7,568 machines, 26% are at least 10 years old; 10% over 20 years old.

80,110 cutoff machines — 33% at least 10 years old; 12% over 20 years old.

	CONTOUR SAWING AND FILING (NOT IN TOTAL)			TOTAL CUTOFF			BANDSAW			ABRASIVE DISK			HACKSAWS			ROTARY HOT OR COLD			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																					
Agricultural Machinery	163	38	7	1,591	364	288	439	90	28	221	42	14	775	211	208	52	7	7	104	14	31
Constr, Mining, Oil Well	70	7	–	1,931	497	227	458	90	27	174	17	3	979	337	117	140	13	53	180	40	27
Metalworking Machinery	557	73	13	4,995	1,029	515	1,679	254	113	683	90	40	2,091	562	264	321	93	65	221	30	33
Special-Industry Mach	486	17	66	5,586	1,204	933	1,993	304	221	668	166	22	2,160	552	425	375	88	138	370	94	127
General Ind. Equip	264	15	11	4,403	1,153	591	1,303	250	114	602	143	7	1,930	639	235	451	110	191	117	11	44
Office and Store Mach	395	53	171	635	163	126	293	57	69	37	8	–	256	94	45	41	–	12	8	4	–
Domestic, Service Equip	174	37	8	2,146	490	342	732	131	101	272	55	15	609	208	75	434	84	124	99	12	27
Electrical Equipment	904	141	103	7,972	1,395	918	2,656	325	266	1,003	145	36	2,657	661	315	775	115	162	881	149	139
Misc. Parts, Jobbing	275	37	–	4,745	797	778	1,365	174	55	586	64	9	1,722	431	293	238	27	64	834	101	357
Motor Vehicles and Parts	173	14	112	3,682	859	757	1,290	262	251	437	110	52	1,044	255	211	601	147	152	310	93	91
Aircraft and Parts	485	14	–	2,791	384	43	1,442	184	23	372	18	2	503	76	16	253	69	–	221	35	2
Railroad Equipment	63	12	8	891	162	183	325	63	53	116	17	3	291	60	58	141	20	56	18	2	13
Fabricated Metal Prod	1,610	273	119	21,391	4,844	2,209	8,204	1,364	569	3,073	470	85	7,365	2,327	1,064	1,102	298	239	1,647	385	252
Ships, Ordnance, Misc	912	302	50	13,111	2,485	1,652	3,576	615	342	1,626	226	72	4,404	1,239	605	1,835	255	430	1,670	150	203
Precision Mechanisms	1,037	200	95	4,240	919	468	1,622	291	48	664	180	11	1,548	357	350	182	60	43	224	31	16
Total	7,568	1,233	763	80,110	16,745	10,030	27,377	4,454	2,280	10,534	1,751	371	28,354	8,011	4,281	6,941	1,386	1,716	6,904	1,143	1,362
BY GEOGRAPHIC AREA																					
Boston	427	51	47	5,014	1,012	795	1,592	196	196	596	90	24	1,968	534	347	366	70	116	492	122	110
Bridgeport – Hartford	396	48	28	2,280	427	369	822	115	84	298	51	23	795	216	169	110	20	45	255	25	48
New England	316	24	53	1,834	370	428	501	97	78	262	39	24	855	190	190	167	39	117	49	5	19
New York – Newark	582	39	20	6,603	1,569	870	2,151	311	106	878	192	5	2,362	933	302	546	54	247	666	79	212
Buffalo – Rochester	200	50	10	1,801	453	184	671	53	20	247	73	10	685	220	37	254	90	97	144	17	20
Philadelphia	365	60	40	4,354	799	550	1,096	183	95	627	191	20	1,505	294	260	800	111	99	326	20	76
Pittsburgh – Wheeling	225	71	13	2,445	536	406	792	106	128	101	22	4	823	251	97	376	73	152	353	84	16
Middle Atlantic	508	108	24	5,813	1,265	887	2,032	309	187	777	139	28	2,190	676	430	400	61	180	414	80	62
Baltimore	15	–	–	560	129	9	296	59	3	33	6	–	80	23	3	6	3	–	145	38	5
Southern	1,040	312	76	7,514	2,062	382	2,036	460	56	1,839	172	11	2,750	1,176	141	617	243	116	272	11	56
Cleveland – Youngstown	155	16	–	3,988	593	385	1,307	138	106	541	81	8	1,446	277	202	342	77	53	352	20	16
Cincinnati – Dayton	200	26	79	1,078	230	155	351	64	53	114	13	6	427	124	63	151	26	27	35	3	6
Detroit – Toledo	165	15	102	3,172	644	533	1,115	231	197	357	75	44	757	179	145	682	84	85	26	75	62
Milwaukee	162	21	18	1,931	345	223	597	63	46	285	32	11	788	208	134	155	35	21	106	7	11
Chicago	662	121	77	6,344	1,433	759	2,532	531	180	791	84	6	2,170	624	319	318	72	45	533	122	209
Indianapolis	50	16	3	365	107	13	134	30	5	66	11	–	131	47	6	28	17	2	6	2	–
Midwestern	952	157	150	12,036	2,658	2,141	4,444	794	533	1,339	337	122	4,314	1,066	894	848	115	246	1,091	346	346
Minneapolis – St. Paul	86	9	–	468	91	39	148	18	7	31	7	5	218	64	27	14	–	–	57	2	–
St. Louis – Kansas City	117	15	11	1,810	223	189	470	77	47	100	4	7	421	120	91	58	18	26	761	4	18
Central and Mountain	239	33	4	2,266	400	286	845	122	41	314	33	7	846	189	193	99	30	15	162	26	30
Houston	17	6	–	278	63	30	64	11	8	34	3	–	147	44	8	11	2	8	22	3	6
Southwestern	122	–	–	3,240	411	145	1,352	157	36	293	36	–	1,351	194	73	121	24	12	123	–	24
San Francisco – Oakland	52	13	–	747	200	89	290	52	19	90	26	–	335	122	64	32	–	6	–	–	–
Los Angeles	340	16	–	2,269	376	75	960	154	10	343	16	3	591	125	42	247	89	10	126	26	10
Pacific	175	6	–	1,900	349	68	979	123	41	178	18	3	399	115	44	193	67	–	151	26	–
Total	7,568	1,233	763	80,110	16,745	10,030	27,377	4,454	2,280	10,534	1,751	371	28,354	8,011	4,281	6,941	1,386	1,716	6,904	1,143	1,362

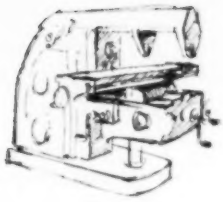
HONING AND LAPPING



(Standard Commodity Code: 3419 30) Includes all types of honing, lapping, and superfinishing machines (except gear honing and lapping). Honing, external and internal lapping, plus surface lapping constitute the total.

17,170 machines—24% at least 10 years old; 5% over 20 years old

	TOTAL HONING & LAPPING			HONING			EXTERNAL LAPPING			INTERNAL LAPPING			SURFACE LAPPING		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	377	86	41	263	66	17	62	17	14	38	3	10	14	–	–
Construction, Mining, Oil Well	193	26	17	157	23	17	13	–	–	20	3	–	3	–	–
Metalworking Machinery	1,455	193	123	660	98	15	354	40	45	243	30	8	198	25	55
Special-Industry Machinery	498	45	34	392	28	17	17	–	–	39	17	–	50	–	17
General Industrial Equipment	873	147	15	562	88	11	62	26	–	106	13	4	143	18	–
Office and Store Machines	57	4	–	45	–	–	12	4	–	–	–	–	–	–	–
Domestic and Service Equip	649	186	26	282	66	5	50	13	3	119	23	15	198	84	3
Electrical Equipment	1,070	123	31	535	51	5	86	–	–	235	42	2	214	30	24
Misc. Machine Parts, Jobbing	3,573	815	110	1,356	403	–	1,090	348	110	724	64	–	403	–	–
Motor Vehicles and Parts	1,882	618	150	678	206	32	151	38	24	503	201	43	550	173	51
Aircraft and Parts	742	72	–	345	35	–	165	7	–	112	18	–	120	12	–
Railroad Equipment	152	18	2	76	3	2	23	8	–	28	8	–	25	2	–
Fabricated Metal Products	2,000	493	118	772	102	8	161	36	–	479	45	51	588	310	59
Shipbuilding, Ordnance, Misc.	2,218	276	142	1,497	169	27	299	44	68	236	24	41	186	39	6
Precision Mechanisms	1,431	178	85	313	78	3	312	38	16	196	3	23	610	59	43
Total	17,170	3,280	894	7,933	1,416	159	2,857	616	280	3,078	496	197	3,302	752	258
BY GEOGRAPHIC AREA															
Boston	1,455	245	180	564	96	8	380	79	74	291	36	38	220	34	60
Bridgeport–Hartford	1,489	384	127	348	42	–	101	6	3	112	20	11	928	316	113
New England	364	78	25	156	24	10	63	–	–	92	34	–	53	20	15
New York–Newark	2,180	279	25	775	69	–	524	111	5	259	64	10	622	35	10
Buffalo–Rochester	373	51	13	184	20	–	47	3	–	75	13	–	67	15	13
Philadelphia	512	103	54	218	16	12	183	67	42	83	12	–	28	8	–
Pittsburgh–Wheeling	119	13	13	93	9	13	13	–	–	4	4	–	9	–	–
Middle Atlantic	1,051	202	17	603	102	–	146	62	3	198	31	14	104	7	–
Baltimore	84	–	21	21	–	3	33	–	18	–	–	–	30	–	–
Southern	1,228	199	45	817	156	–	236	37	45	71	–	–	104	6	–
Cleveland–Youngstown	823	57	28	399	41	12	126	–	–	225	12	16	73	4	–
Cincinnati–Dayton	252	66	9	121	11	2	10	3	–	45	5	2	76	47	5
Detroit–Toledo	2,048	584	117	1,155	230	30	167	54	23	491	188	46	235	112	18
Milwaukee	187	32	18	123	18	11	18	14	–	11	–	–	35	–	7
Chicago	1,598	193	26	413	77	–	274	67	13	570	13	–	341	36	13
Indianapolis	94	17	5	41	11	–	39	3	3	2	–	2	12	3	–
Midwestern	2,178	617	124	1,156	369	41	367	92	36	341	53	43	314	103	4
Minneapolis–St. Paul	86	9	–	63	9	–	2	–	–	7	–	–	14	–	–
St. Louis–Kansas City	184	26	4	110	22	–	15	–	–	48	4	4	11	–	–
Central and Mountain	371	55	33	219	33	7	58	15	15	87	7	11	7	–	–
Houston	50	6	–	25	6	–	8	–	–	17	–	–	–	–	–
Southeastern	102	36	–	89	36	–	13	–	–	–	–	–	–	–	–
San Francisco–Oakland	6	–	–	–	–	–	6	–	–	–	–	–	–	–	–
Los Angeles	282	19	10	202	13	12	13	–	–	48	–	–	19	6	–
Pacific	54	9	–	38	6	–	15	3	–	1	–	–	–	–	–
Total	17,170	3,280	894	7,933	1,416	159	2,857	616	280	3,078	496	197	3,302	752	258

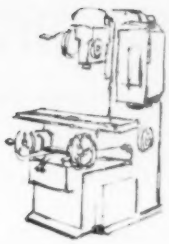


MILLING MACHINES

182,284 machines—45% at least 10 years old; 25% over 20 years old

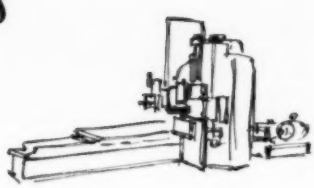
	TOTAL MILLING MACHINES			BENCH TYPE			HAND			KNEE TYPE HORIZONTAL			VERTICAL		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	4,032	937	1,032	28	10	–	408	121	114	1,059	242	315	868	114	173
Construction, Mining, Oil Well	2,592	621	614	40	7	7	214	27	53	1,205	161	377	418	67	67
Metalworking Machinery	20,789	4,268	5,718	438	123	55	1,345	324	377	8,820	2,181	2,302	4,136	796	409
Special–Industry Machinery	16,372	3,378	5,659	370	68	144	1,601	469	679	7,413	1,628	2,683	2,561	491	602
General Industrial Equipment	8,742	1,805	1,669	301	95	40	1,387	378	297	3,321	749	749	1,218	187	106
Office and Store Machines	8,072	1,400	2,702	322	114	85	1,608	183	582	2,002	366	1,095	537	102	151
Domestic and Service Equip	3,757	763	896	179	42	27	728	172	164	1,375	222	215	642	129	82
Electrical Equipment	15,560	2,935	3,046	1,027	203	146	2,332	378	659	5,537	1,377	1,366	3,369	581	481
Misc. Machine Parts, Jobbing	7,676	1,933	1,310	449	174	16	1,282	183	238	2,821	916	605	1,466	266	174
Motor Vehicles and Parts	11,063	2,728	2,894	99	22	27	1,875	461	696	2,461	527	973	1,369	290	348
Aircraft and Parts	5,969	802	143	147	32	2	547	92	12	2,129	358	85	1,428	159	25
Railroad Equipment	1,419	226	330	8	–	3	125	13	45	526	85	151	355	66	42
Fabricated Metal Products	32,798	7,083	9,852	1,562	354	319	7,854	1,964	3,321	9,806	2,090	2,713	5,015	909	666
Shipbuilding, Ordnance, Misc.	31,623	5,228	6,433	1,057	276	57	1,747	335	734	7,874	1,761	1,393	7,187	1,112	994
Precision Mechanisms	12,421	2,620	2,437	1,762	500	347	1,946	286	617	4,521	1,201	1,098	1,636	407	95
Total	182,284	36,719	45,106	7,789	2,037	1,277	24,999	5,386	8,590	60,761	14,064	16,120	32,005	5,766	4,415
BY GEOGRAPHIC AREA															
Boston	20,040	3,635	6,134	951	192	403	2,676	649	1,033	5,858	1,125	1,958	2,454	431	421
Bridgeport–Hartford	16,029	1,858	7,479	340	116	84	3,306	403	1,953	3,357	596	1,672	1,871	233	287
New England	7,556	1,293	3,199	224	44	87	1,085	117	568	2,876	661	1,322	1,249	282	365
New York–Newark	13,162	3,303	2,556	815	254	33	1,695	416	332	4,423	1,361	937	3,138	597	601
Buffalo–Rochester	4,757	998	1,218	254	70	67	936	170	310	1,346	377	407	842	140	120
Philadelphia	5,744	1,343	1,116	294	71	20	644	115	169	2,484	607	627	973	242	139
Pittsburgh–Wheeling	2,709	649	556	22	9	–	287	40	71	1,023	247	238	657	190	137
Middle Atlantic	15,243	2,919	3,383	715	97	80	1,746	464	460	5,617	1,184	1,212	2,881	437	551
Baltimore	1,159	356	140	198	51	–	151	33	68	355	158	33	385	116	33
Southern	11,385	3,874	826	1,200	473	28	620	118	155	4,703	1,652	392	3,261	698	52
Cleveland–Youngstown	10,317	1,709	2,851	252	77	12	1,497	446	356	3,684	582	1,058	1,612	265	228
Cincinnati–Dayton	3,797	609	1,053	77	21	27	678	92	138	1,298	214	427	557	72	71
Detroit–Toledo	9,999	2,355	3,003	159	12	24	1,754	317	699	2,385	549	780	1,290	270	288
Milwaukee	3,527	820	528	77	32	4	493	113	70	1,422	320	246	546	70	56
Chicago	12,298	3,404	1,815	904	160	204	1,541	485	491	4,604	1,518	733	2,151	565	71
Indianapolis	1,071	324	46	42	14	–	136	45	12	318	114	19	222	53	3
Midwestern	26,558	4,259	6,141	697	214	171	3,527	831	999	8,946	1,422	2,599	5,467	778	732
Minneapolis–St. Paul	901	188	127	15	7	–	151	43	14	309	77	45	220	25	18
St. Louis–Kansas City	2,700	614	1,063	62	14	14	592	109	229	680	150	453	386	25	84
Central and Mountain	3,491	758	827	107	33	11	541	122	169	1,426	319	338	461	111	67
Houston	661	128	169	6	–	–	19	3	3	344	89	100	122	9	–
Southern	1,972	484	488	94	–	–	242	85	24	769	268	182	354	24	12
San Francisco–Oakland	1,055	276	224	109	39	–	167	64	19	412	103	129	186	37	45
Los Angeles	2,866	456	124	116	12	6	327	71	16	1,226	244	41	569	42	22
Pacific	1,223	247	104	60	–	–	168	35	12	700	160	66	176	32	12
Total	182,284	36,719	45,106	7,789	2,037	1,277	24,999	5,386	8,590	60,761	14,064	16,120	32,005	5,766	4,415

(Standard Commodity Code: 3417 00) Includes bench and hand millers (3417 10); horizontal, vertical, automatic, and manufacturing, knee type machines (3417 20); bed (Lincoln) type, including automatic rise and fall (3417 40); planer type (3417 50); die sinkers and profilers, except engraving and duplicating machines (3417 60 & 70); all other types, including splinemillers, routers, spar millers, engravers, drum, cam, and traveling housing types, also ram type swivel head including all knee-type with spindle head arranged for universal angle rotation (3417 30 & 90). Thread milling equipment is tallied in the Threading tables.



	AUTOMATIC AND MANUFACTURING			BED (LINCOLN) TYPE INCL AUT RISE AND FALL			PLANER TYPE			DIE SINKERS (EXCEPT ENGRAVING) & DUPLICATORS			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	1,038	187	197	149	28	24	280	66	121	42	3	–	360	166	59
Construction, Mining, Oil Well	277	43	40	104	43	3	154	53	37	27	10	7	63	10	23
Metalworking Machinery	1,770	173	806	904	196	276	763	206	198	392	65	50	2,221	196	1,245
Special–Industry Machinery	2,429	453	817	408	11	85	502	83	265	232	6	11	856	149	375
General Industrial Equipment	778	161	121	220	26	51	378	121	99	44	–	15	495	88	191
Office and Store Machines	2,568	476	370	195	4	61	16	–	8	41	8	16	781	147	334
Domestic and Service Equip.	505	116	78	261	30	56	52	12	17	40	12	2	175	28	55
Electrical Equipment	1,447	123	72	303	43	38	283	36	81	263	42	24	999	155	179
Misc. Machine Parts, Jobbing	568	82	46	540	137	92	137	37	64	147	46	18	266	92	55
Motor Vehicles and Parts	1,843	409	530	1,275	363	323	108	32	37	166	44	48	1,867	579	512
Aircraft and Parts	612	35	11	301	12	4	106	30	4	274	34	–	425	50	–
Railroad Equipment	106	25	13	123	10	2	63	12	32	25	5	5	88	10	37
Fabricated Metal Products	4,119	694	1,061	1,059	161	596	563	172	222	927	269	181	1,893	360	771
Shipbuilding, Ordnance, Misc.	4,036	493	384	3,029	207	810	583	115	198	2,513	608	524	3,607	421	1,347
Precision Mechanisms	1,099	67	94	545	17	17	126	53	62	350	50	–	436	39	107
Total	23,185	3,537	4,640	9,416	1,288	2,436	4,114	1,029	1,437	5,483	1,102	901	14,532	2,510	5,290
BY GEOGRAPHIC AREA															
Boston	4,267	841	345	263	54	71	319	66	118	426	62	111	2,826	214	1,674
Bridgeport–Hartford	3,035	281	577	1,163	20	1,122	268	61	129	382	39	135	2,307	107	1,520
New England	1,054	97	533	292	–	68	228	34	131	190	–	5	358	58	120
New York–Newark	850	222	297	335	10	20	580	162	227	712	173	114	614	108	83
Buffalo–Rochester	729	117	217	140	20	7	130	7	23	57	17	7	321	80	60
Philadelphia	488	99	32	267	44	28	79	40	12	52	8	8	463	117	81
Pittsburgh–Wheeling	84	–	4	40	9	4	97	57	18	102	18	4	397	79	80
Middle Atlantic	1,280	257	285	1,191	190	302	297	60	121	680	62	77	838	168	195
Baltimore	3	3	–	27	6	–	18	3	6	6	–	–	15	6	–
Southern	844	135	6	804	170	34	222	84	28	881	284	75	850	260	56
Cleveland–Youngstown	1,791	147	974	669	53	49	284	86	45	198	4	48	330	49	81
Cincinnati–Dayton	489	98	69	264	40	64	53	5	6	19	3	–	362	64	151
Detroit–Toledo	1,459	367	382	1,053	302	284	83	27	25	189	48	72	1,628	463	449
Milwaukee	169	39	7	266	63	42	165	70	46	136	18	11	275	95	46
Chicago	1,100	206	71	614	71	26	226	55	109	473	143	46	685	161	64
Indianapolis	123	23	5	117	33	5	11	5	–	20	9	–	81	28	2
Midwestern	3,762	435	551	1,559	131	260	703	113	244	585	148	165	1,262	187	420
Minneapolis–St. Paul	82	9	2	5	–	–	73	18	23	34	7	–	14	2	5
St. Louis–Kansas City	434	66	109	139	22	26	18	7	11	66	4	–	123	37	37
Central and Mountain	482	82	134	90	26	15	131	38	63	71	15	4	182	52	26
Houston	66	–	–	19	3	–	8	–	–	29	11	3	49	22	2
Southwestern	242	–	121	12	12	–	24	–	24	–	–	–	236	97	121
San Francisco–Oakland	32	16	6	32	6	6	14	6	6	32	6	–	58	–	12
Los Angeles	241	–	3	32	3	–	61	13	22	128	19	10	186	81	–
Pacific	79	–	–	20	–	3	23	12	–	55	3	8	72	5	3
Total	23,185	3,537	4,640	9,416	1,288	2,436	4,114	1,029	1,437	5,483	1,102	901	14,532	2,510	5,290

PLANERS, RIFLE WORKING MACHINES

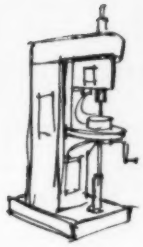


(Standard Commodity Code: 3418 00 for Planers) Includes double housing (3418 10); openside (3418 20); and all other types not otherwise listed (3418 30, 40, 50, 60, 70 & 90). Rifle working machines (3419 60) are not included in the planer total. Of these there are 908—15% are at least 10 years old; 8% over 20 years old.

16,570 Planers—75% at least 10 years old; 55% over 20 years old

	TOTAL PLANERS			DOUBLE HOUSING			OPENSIDE			OTHER			RIFLE WORKING MACHINES (NOT IN TOTAL)		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	231	65	125	138	35	83	76	20	35	17	10	7	3	3	–
Construction, Mining, Oil Well	504	94	321	424	77	277	73	17	37	7	–	7	3	–	–
Metalworking Machinery	3,318	638	1,504	2,535	472	1,283	590	128	156	193	38	65	3	3	–
Special-Industry Machinery	2,451	492	1,534	1,590	348	1,104	524	105	315	337	39	215	–	–	–
General Industrial Equipment	646	140	415	426	92	297	169	26	92	51	22	26	7	–	–
Office and Store Machines	81	28	52	41	12	28	28	12	16	12	4	8	–	–	–
Domestic and Service Equip.	199	57	53	83	20	40	63	29	7	53	8	8	3	–	–
Electrical Equipment	594	122	334	354	36	239	139	64	44	101	22	51	–	–	–
Misc. Machine Parts, Jobbing	1,036	293	650	834	238	540	147	37	73	55	18	37	–	–	–
Motor Vehicles and Parts	417	98	207	257	52	149	152	43	57	8	3	1	4	1	–
Aircraft and Parts	105	16	13	40	9	9	58	5	2	7	2	2	–	–	–
Railroad Equipment	457	33	01	377	20	257	60	13	27	20	–	17	3	–	–
Fabricated Metal Products	2,772	682	1,695	1,588	381	1,061	751	207	367	433	94	267	–	–	–
Shipbuilding, Ordnance, Misc.	3,553	493	1,804	2,007	221	1,180	974	173	353	572	99	271	882	50	77
Precision Mechanisms	206	35	153	94	20	75	41	4	37	71	11	41	–	–	–
Total	16,570	3,286	9,163	10,788	2,033	6,622	3,845	883	1,518	1,937	370	1,023	908	67	77
BY GEOGRAPHIC AREA															
Boston	1,502	278	845	937	145	668	488	98	118	157	35	59	283	29	14
Bridgeport–Hartford	703	118	492	554	93	407	84	14	37	65	11	48	82	7	37
New England	778	116	534	457	53	330	178	39	97	146	24	107	–	–	–
New York–Newark	1,005	232	597	641	158	404	158	49	59	206	25	134	–	–	–
Buffalo–Rochester	351	76	216	207	23	150	107	50	33	37	3	33	–	–	–
Philadelphia	846	174	417	467	95	250	266	67	127	123	12	40	8	–	–
Pittsburgh–Wheeling	432	124	212	291	53	172	119	53	40	22	18	–	–	–	–
Middle Atlantic	1,665	152	1,084	1,309	121	891	219	21	108	137	10	85	144	3	14
Baltimore	39	15	21	21	3	18	18	12	3	–	–	–	–	–	–
Southern	1,475	355	578	903	226	447	375	107	35	197	22	96	185	24	12
Cleveland–Youngstown	750	142	326	558	85	236	151	57	57	41	–	33	–	–	–
Cincinnati–Dayton	546	100	220	456	82	206	79	18	6	11	–	8	5	–	–
Detroit–Toledo	395	81	191	246	46	139	125	31	47	24	4	5	–	–	–
Milwaukee	599	120	299	398	81	236	127	28	21	74	11	42	–	–	–
Chicago	944	258	540	527	161	293	245	39	174	172	58	73	–	–	–
Indianapolis	41	11	5	22	6	3	16	5	2	3	–	–	–	–	–
Midwestern	3,145	639	1,812	2,036	398	1,289	752	141	351	358	100	172	182	–	–
Minneapolis–St. Paul	69	18	32	44	9	27	14	–	5	11	9	–	–	–	–
St. Louis–Kansas City	246	39	145	173	25	109	51	14	14	22	–	22	–	–	–
Central and Mountain	315	89	171	217	67	130	67	15	30	31	7	11	4	4	–
Houston	15	6	6	9	3	6	3	–	–	3	3	–	3	–	–
Southwestern	282	72	182	146	48	85	88	12	73	48	12	24	–	–	–
San Francisco–Oakland	135	19	110	64	13	52	45	–	39	26	6	19	–	–	–
Los Angeles	141	29	58	61	19	39	67	10	16	13	–	3	–	–	–
Pacific	151	23	70	55	20	35	86	3	26	10	–	9	12	–	–
Total	16,570	3,286	9,163	10,788	2,033	6,622	3,845	883	1,518	1,937	370	1,023	908	67	77

THREADING except pipe



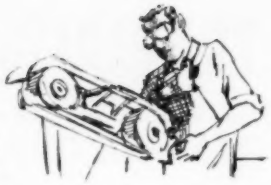
(Standard Commodity Code: 3419 70; 3415 50; 3449 10) Includes tapping machines, as horizontal, vertical, radial arm, nut, coupling, shell; threading machines except pipe equipment (3419 70); hobbing and milling (3417 50); thread rolling (3449 10); thread grinders (3415 50); all other threading equipment not otherwise listed.

54,029 machines—54% are at least 10 years old; 35% over 20 years old

	TOTAL THREADING (EXCEPT PIPE)			TAPPING			HOBBING AND MILLING			DIE TYPE			THREAD GRINDERS			THREAD ROLLERS			OTHERS		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																					
Agricultural Machinery	1,151	339	312	453	149	125	232	52	55	266	100	80	7	–	–	55	10	21	138	28	31
Constr, Mining, Oil Well	654	202	111	124	43	20	200	73	10	214	67	67	73	3	–	10	3	7	33	13	7
Metalworking Machinery	2,853	593	562	547	118	85	1,071	231	306	218	85	58	781	113	50	95	13	25	141	33	38
Special-Industry Mach	1,420	315	414	602	105	149	381	116	132	243	66	99	39	6	6	17	–	6	138	22	22
General Ind. Equip	1,917	536	304	749	180	51	672	235	165	239	66	51	136	29	–	29	–	–	92	26	37
Office and Store Mach	1,424	342	675	1,351	342	651	8	–	4	16	–	8	12	–	–	37	–	12	–	–	–
Domestic, Service Eqpt	1,572	370	363	1,171	301	283	115	22	12	81	20	32	77	–	–	95	23	21	33	4	15
Electrical Equipment	4,733	714	792	3,198	511	327	588	73	272	256	29	50	237	2	2	383	82	110	71	17	31
Misc. Parts, Jobbing	1,870*	513	183	687	202	82	211	55	37	403	110	46	147	–	–	92	9	–	330	137	18
Motor Vehicles and Parts	3,344	966	1,095	1,937	658	584	263	66	67	544	170	220	188	8	5	401	61	216	11	3	3
Aircraft and Parts	1,114	106	7	428	21	–	269	42	5	28	7	–	320	34	2	28	–	–	41	2	–
Railroad Equipment	383	48	163	158	20	66	22	2	7	128	10	70	22	2	–	33	7	12	20	7	8
Fabricated Metal Prod	24,264	3,942	13,229	7,352	1,176	2,187	591	212	99	2,427	832	679	370	24	–	3,414	1,028	1,362	10,110	670	8,902
Ships, Ordnance, Misc.	4,734	787	559	2,292	362	240	1,170	190	59	393	129	112	506	26	6	105	8	27	268	72	115
Precision Mechanisms	2,596	552	323	1,640	404	133	129	23	34	22	3	–	93	3	–	155	37	14	557	82	142
Total	54,029	10,325	19,092	22,689	4,592	4,983	5,922	1,392	1,264	5,478	1,694	1,572	3,008	250	71	4,949	1,281	1,833	11,983	1,116	9,369
BY GEOGRAPHIC AREA																					
Boston	3,984	505	1,096	1,450	122	270	807	174	189	293	43	106	488	71	35	370	71	194	576	24	302
Bridgeport – Hartford	7,732	509	5,284	2,163	261	1,035	459	110	101	221	59	76	195	20	–	581	39	346	4,113	20	3,726
New England	1,410	277	430	455	136	49	174	44	97	102	29	39	167	10	–	168	24	15	344	34	230
New York – Newark	3,651	517	783	1,952	306	89	225	64	59	239	49	–	168	5	5	363	54	120	704	39	510
Buffalo – Rochester	1,665	357	484	792	194	94	94	13	43	94	33	20	67	3	–	57	20	7	561	94	320
Philadelphia	1,899	286	879	449	83	44	159	44	28	341	127	71	48	8	–	147	8	48	755	16	688
Pittsburgh – Wheeling	1,190	247	653	564	75	322	66	18	18	291	79	159	22	4	–	243	71	150	4	–	4
Middle Atlantic	3,946	756	1,329	1,622	201	411	452	104	90	694	278	187	255	24	14	318	104	124	605	45	503
Baltimore	92	46	15	56	33	6	9	–	6	12	3	3	12	9	–	3	–	–	–	1	–
Southern	3,505	878	385	1,638	433	51	878	220	28	406	180	67	217	–	–	37	6	–	329	39	239
Cleveland – Youngstown	2,879	415	991	1,250	114	362	315	48	138	262	45	49	230	27	4	377	181	114	445	–	324
Cincinnati – Dayton	940	238	281	707	201	240	81	14	10	47	8	18	42	2	–	42	11	5	21	2	8
Detroit – Toledo	2,814	704	955	1,543	457	442	220	50	51	472	143	186	178	8	4	390	44	272	11	2	–
Milwaukee	619	141	137	264	63	49	74	21	18	190	42	70	56	–	–	14	4	–	21	11	–
Chicago	4,349	816	1,283	2,075	463	341	403	60	180	402	58	58	254	6	–	573	216	203	642	13	501
Indianapolis	288	89	7	178	56	3	42	16	2	14	8	–	41	9	–	8	–	2	5	–	–
Midwestern	8,897	2,390	3,248	3,320	771	808	895	146	142	858	356	297	304	34	9	1,073	364	176	2,447	719	1,816
Minneapolis – St. Paul	219	60	27	157	48	14	9	5	–	14	5	2	9	–	–	23	2	9	7	–	2
St. Louis – Kansas City	1,222	399	347	982	318	266	40	–	26	47	4	22	18	–	–	88	55	22	47	22	11
Central and Mountain	1,015	337	148	483	148	52	140	67	26	269	96	70	38	7	–	7	4	–	78	15	–
Houston	273	89	6	17	–	–	144	69	6	14	3	–	61	3	–	–	–	–	37	14	–
Southwestern	684	133	233	185	36	–	157	73	–	88	24	48	36	–	–	12	–	–	206	–	185
San Francisco – Oakland	129	51	51	52	26	19	19	19	–	13	6	6	6	–	–	39	–	26	–	–	–
Los Angeles	411	54	22	225	29	10	42	13	6	51	6	6	64	–	–	16	3	–	13	3	–
Pacific	216	31	18	110	18	6	18	–	–	44	10	12	32	–	–	–	–	–	12	3	–
Total	54,029	10,325	19,092	22689	4,592	4,983	5922	1,392	1,264	5,478	1,694	1,572	3008	250	71	4949	1,281	1,833	11983	1,116	9,369

POLISHING & BUFFING MACHINES

PIPE CUTTING & THREADING MACHINES

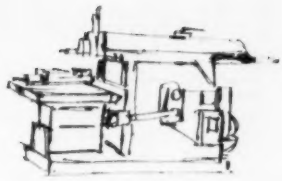


(Standard Commodity Code 3419 40, 3419 70) Includes speed lathes, polishing stands, abrasive belt types, and all other equipment not elsewhere classified. Pipe cutting and threading equipment totals 12,419 machines of which 46% are at least 10 years old; 19% over 20 years old. This total is not part of polishing machine tallies.

85,735 polishing and buffing machines—39% are at least 10 years old; 19% over 20 years old

	PIPE CUTTING & THREADING (NOT IN TOTAL)			TOTAL POLISHING & BUFFING			SPEED LATHES			POLISHING STANDS			ABRASIVE BELT			OTHER		
	TOTAL	10–20 YEARS	OVER 20 YR	TOTAL	10–20 YEARS	OVER 20 YR	TOTAL	10–20 YEARS	OVER 20 YR	TOTAL	10–20 YEARS	OVER 20 YR	TOTAL	10–20 YEARS	OVER 20 YR	TOTAL	10–20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	263	42	80	1,138	163	151	111	28	24	522	87	100	93	31	3	412	17	24
Construction, Mining, Oil Well	424	124	127	274	46	80	37	10	13	174	23	57	30	–	–	33	13	10
Metalworking Machinery	489	103	103	3,353	578	774	1,358	201	324	1,320	264	424	555	90	23	120	23	3
Special-Industry Machinery	800	232	160	5,449	1,098	1,679	2,103	364	751	1,886	469	668	1,038	182	166	420	83	94
General Industrial Equipment	653	178	132	2,117	414	279	708	165	66	796	150	165	499	73	33	114	26	15
Office and Store Machines	69	24	12	1,758	636	639	167	37	37	1,356	562	558	134	4	20	41	33	4
Domestic and Service Equip.	276	83	40	3,202	718	891	593	164	171	1,730	404	553	294	32	38	585	118	129
Electrical Equipment	912	201	151	5,785	1,339	713	1,599	372	296	2,853	308	215	1,214	315	85	119	44	17
Misc. Machine Parts, Jobbing	623	293	64	2,828	742	604	2,418	394	531	806	183	55	577	165	9	27	–	9
Motor Vehicles and Parts	568	138	147	8,326	2,355	1,806	2,201	569	634	3,987	1,057	886	677	173	55	1,461	556	231
Aircraft and Parts	129	16	–	2,719	503	46	704	131	14	1,106	294	25	463	62	–	444	46	7
Railroad Equipment	178	40	60	340	67	47	101	17	30	149	43	12	83	5	2	35	2	3
Fabricated Metal Products	3,665	1,132	600	30,469	5,527	6,656	7,487	1,589	1,281	14,948	3,112	4,265	4,997	694	298	3,037	132	812
Shipbuilding, Ordnance, Misc.	2,006	769	701	10,769	2,172	640	1,571	225	105	7,911	1,600	435	893	110	13	394	37	87
Precision Mechanisms	364	30	37	6,220	1,217	657	2,425	394	458	2,358	609	122	1,138	193	71	499	21	6
Total	12,419	3,401	2,414	85,735	17,305	15,662	23,583	4,660	4,855	41,746	9,365	8,540	12,665	2,129	816	7,741	1,151	1,451
BY GEOGRAPHIC AREA																		
Boston	612	180	98	7,173	1,267	1,765	2,533	547	686	3,536	463	953	1,109	153	71	492	106	55
Bridgeport–Hartford	242	51	72	3,467	1,168	2,421	2,246	200	528	4,370	1,663	1,458	724	56	98	1,427	220	337
New England	467	112	92	3,419	517	1,320	1,072	190	481	1,340	299	465	421	19	73	586	19	301
New York–Newark	691	163	79	9,030	1,728	723	2,244	568	107	4,726	966	322	1,473	153	84	567	39	10
Buffalo–Rochester	204	73	33	2,672	778	220	1,042	297	84	1,249	414	100	264	47	13	117	20	23
Philadelphia	790	135	198	3,631	754	838	1,726	315	464	1,245	218	322	957	193	44	103	28	8
Pittsburgh–Wheeling	428	181	79	1,515	556	251	379	255	40	691	194	101	335	75	44	110	22	66
Middle Atlantic	1,039	219	436	5,336	862	1,164	1,243	200	388	2,373	412	745	1,252	212	17	468	38	14
Baltimore	44	13	6	288	15	9	33	–	3	145	12	6	101	3	–	9	–	–
Southern	1,702	797	153	6,545	1,207	419	2,315	298	146	2,908	737	212	1,081	180	22	241	22	39
Cleveland–Youngstown	623	151	41	4,721	930	393	1,201	147	151	2,711	702	238	540	53	4	269	28	–
Cincinnati–Dayton	203	48	52	1,218	247	194	150	23	29	832	163	159	155	35	3	111	26	3
Detroit–Toledo	739	87	100	6,549	1,463	1,429	1,574	409	569	3,176	643	648	583	40	22	1,214	371	190
Milwaukee	211	67	60	1,143	228	113	373	77	46	472	95	56	236	56	4	60	–	7
Chicago	1,162	251	84	5,612	1,119	494	1,676	302	130	2,639	727	293	1,017	71	26	280	19	45
Indianapolis	36	22	3	511	95	15	126	31	3	207	42	9	89	16	3	89	6	–
Midwestern	3,006	287	519	11,192	2,446	2,621	2,590	697	661	5,871	1,287	1,357	1,461	364	280	1,275	98	323
Minneapolis–St. Paul	93	11	18	221	39	7	176	23	5	100	14	–	50	2	–	5	–	2
St. Louis–Kansas City	221	55	55	2,538	920	815	248	11	99	2,059	854	712	183	26	4	48	29	–
Central and Northern	418	160	48	1,604	435	282	422	134	26	906	208	237	209	78	4	67	15	15
Houston	41	20	–	53	17	–	33	17	–	11	–	–	9	–	–	–	–	–
Southwestern	141	102	121	598	194	73	169	46	–	280	63	72	137	61	–	12	–	–
San Francisco–Oakland	142	45	33	206	70	26	39	19	–	116	26	26	12	6	–	19	19	–
Los Angeles	189	67	22	935	162	58	257	10	6	421	100	39	180	26	–	77	26	13
Pacific	172	44	18	402	63	12	111	12	3	180	44	9	67	4	–	95	–	–
Total	12,419	3,401	2,414	85,735	17,305	15,662	23,583	4,660	4,855	41,746	9,365	8,540	12,665	2,129	816	7,741	1,151	1,451

SHAPERS
OTHER MACHINE TOOLS

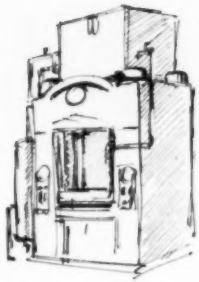


(Standard Commodity Code: 3419 10 & 90) Includes horizontal and vertical shapers, all types of slotters, plus keyseaters. To avoid confusion, "other machine tools," which total 24,591 of which 49% are at least 10 years old and 27% are over 20 years old, are not included in the total for shapers.

42,147 shaper type machines—63% are at least 10 years old; 35% over 20 years old

	TOTAL SHAPERS			HORIZONTAL			VERTICAL INCLUDING SLOTTERS			KEYSEATERS			OTHER MACHINE TOOLS (NOT IN TOTAL)		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	681	159	322	450	135	190	138	18	87	93	14	45	324	76	83
Construction, Mining, Oil Well	1,119	377	404	671	217	217	167	53	70	281	107	117	79	23	10
Metalworking Machinery	4,163	1,293	1,292	3,077	1,017	896	622	138	193	464	138	203	2,164	261	690
Special-Industry Machinery	3,522	1,015	1,501	2,407	662	1,065	392	127	132	723	226	304	9,440	2,374	3,235
General Industrial Equip	2,140	536	870	1,259	297	521	272	48	92	609	191	257	887	99	275
Office and Store Machines	395	106	130	362	94	118	33	12	12	–	–	–	334	81	191
Domestic and Service Equip	835	277	230	645	221	173	117	27	30	73	29	27	405	86	31
Electrical Equipment	3,549	842	1,208	2,653	695	833	606	101	242	290	46	133	2,525	414	302
Misc. Machine Parts, Jobbing	2,373	770	724	1,786	531	395	266	92	37	321	147	92	1,420	256	449
Motor Vehicles and Parts	2,008	541	822	1,612	436	645	273	56	117	123	29	60	1,586	615	372
Aircraft and Parts	635	102	41	497	76	32	110	21	7	28	5	2	650	85	18
Railroad Equipment	619	124	316	370	86	158	206	28	133	43	10	25	88	17	53
Fabricated Metal Products	11,577	3,680	3,861	9,704	3,108	3,298	1,373	445	372	500	127	191	2,007	641	357
Shipbuilding, Ordnance, Misc.	7,151	1,450	2,433	4,865	1,568	1,686	1,794	269	503	492	113	244	1,223	251	383
Precision Mechanisms	1,380	391	410	1,275	354	387	82	37	3	23	–	20	1,550	211	169
Total	42,147	11,663	14,564	31,633	9,017	10,814	6,451	1,464	2,030	4,063	1,182	1,720	24,591	5,490	6,618
BY GEOGRAPHIC AREA															
Boston	2,586	774	896	1,780	551	637	551	141	149	255	82	110	10,561	2,635	2,273
Bridgeport – Hartford	2,275	5,361	536	1,892	479	1,071	273	37	141	110	20	53	551	90	177
New England	1,359	316	698	1,091	253	542	83	19	44	185	44	112	1,453	194	1,157
New York – Newark	2,909	895	1,127	2,277	747	915	376	54	148	256	94	64	1,104	177	29
Buffalo – Rochester	1,136	327	314	808	237	184	204	67	53	124	23	77	324	50	60
Philadelphia	2,144	545	775	1,752	457	616	281	64	115	111	24	44	1,167	115	774
Pittsburgh – Wheeling	1,026	305	428	714	221	291	212	49	88	110	35	49	794	168	273
Middle Atlantic	4,262	916	1,858	3,019	669	1,310	899	153	409	344	94	139	1,277	139	264
Baltimore	244	58	42	196	38	27	33	20	3	15	–	12		–	–
Southern	3,740	1,237	622	2,697	968	448	741	172	84	302	97	90	458	39	45
Cleveland – Youngstown	2,342	670	657	1,821	552	507	317	69	73	204	49	77	476	94	57
Cincinnati – Dayton	756	175	240	552	135	163	130	26	40	74	14	37	237	47	121
Detroit – Toledo	1,777	469	720	1,467	398	607	188	46	63	122	25	60	1,463	569	329
Milwaukee	1,101	215	432	761	165	260	172	18	102	148	32	70	232	53	77
Chicago	2,947	1,090	809	2,352	801	627	344	186	77	251	103	96	457	116	135
Indianapolis	189	68	11	147	55	9	33	11	2	9	2	–	–	–	–
Midwestern	6,833	1,768	2,395	5,046	1,395	1,731	1,082	205	308	705	168	356	2,522	676	609
Minneapolis – St. Paul	264	93	53	155	57	14	62	16	23	47	20	16	93	30	23
St. Louis – Kansas City	806	157	289	612	124	212	143	18	51	51	15	26	190	58	47
Central and Mountain	1,062	327	267	813	234	204	129	48	30	120	45	33	186	45	37
Houston	143	49	20	88	30	14	44	11	6	11	8	–	33	3	–
Southwestern	833	339	266	541	218	169	26	12	–	266	109	97	109	12	24
San Francisco – Oakland	277	58	160	200	39	122	6	–	6	71	19	32	103	32	32
Los Angeles	655	193	102	485	135	67	67	10	3	103	48	32	687	119	19
Pacific	471	63	117	347	59	67	55	12	12	69	12	38	114	29	6
Total	42,147	11,663	14,564	31,633	9,017	10,814	6,451	1,464	2,030	4,063	1,182	1,720	24,511	5,490	6,618

Hydraulic and Pneumatic PRESSES

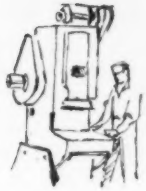


(Standard Commodity Code; 3442 00) Includes all vertical single action (3442 10); vertical double and triple action (3442 20 & 30); horizontal, single action (3442 50); others not elsewhere classified including combination horizontal and vertical, multi-die slide, and die spotting presses (3442 90). Pneumatic presses, listed separately, total 5089, of which 18% are at least 10 years old; 7% over 20 years old.

32,159 hydraulic presses—37% are at least 10 years old; 17% over 20 years old

	TOTAL HYDRAULIC PRESSES			VERTICAL SINGLE ACTION			VERTICAL DOUBLE & TRIPLE ACTION			HORIZONTAL			OTHER (INCLUDING HYDRO-PNEUMATIC)			TOTAL PNEUMATIC (NOT IN TOTAL)		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	931	210	128	370	93	24	97	10	7	173	48	38	291	59	59	675	152	73
Construction, Mining, Oil Well	1,093	233	208	608	117	77	154	53	17	261	60	97	70	3	17	23	3	13
Metalworking Machinery	1,220	201	151	861	143	95	45	3	3	123	25	45	191	30	8	103	8	35
Special-Industry Machinery	1,650	436	475	850	155	144	298	132	99	342	99	160	160	50	72	39	11	–
General Industrial Equip.	1,355	334	305	940	220	176	121	15	48	202	88	55	92	11	26	279	33	51
Office and Store Machines	386	24	–	334	20	–	16	4	–	8	–	–	28	–	–	57	4	4
Domestic and Service Equip.	965	213	54	785	184	42	79	8	5	34	10	2	67	11	5	248	23	8
Electrical Equipment	5,087	726	1,210	4,338	647	1,042	406	32	57	162	38	66	181	9	45	913	47	45
Misc. Machine Parts, Jobbing	1,741	403	330	1,310	275	202	119	37	18	211	73	92	101	18	18	82	–	–
Motor Vehicles and Parts	1,383	486	108	932	309	83	41	8	3	65	10	18	345	159	4	189	15	44
Aircraft and Parts	731	73	11	559	64	7	71	5		32	–		69	4	4	110	19	–
Railroad Equipment	478	70	207	324	42	146	31	3	23	61	20	33	12	5	5	50	2	7
Fabricated Metal Products	6,337	1,260	694	4,554	974	501	564	92	93	539	94	86	680	100	14	1,289	75	18
Shipbuilding, Ordnance, Misc.	7,770	765	1,630	5,102	527	906	386	24	147	935	111	408	1,347	103	169	502	195	36
Precision Mechanisms	1,032	86	51	963	79	51	18	–	–	–	–	–	51	7	–	520	7	–
Total	32,159	5,520	5,562	22,830	3,849	3,496	2,496	426	520	3,148	676	1,100	3,685	569	446	5,089	594	334
BY GEOGRAPHIC AREA																		
Boston	2,223	332	506	1,415	144	310	361	106	71	94	27	39	353	55	86	201	9	12
Bridgeport – Hartford	924	95	65	674	73	31	73	8	8	79	2	20	98	11	6	303	22	–
New England	743	64	58	651	49	34	24	5		49	10	24	19			10		
New York – Newark	1,844	227	257	1,425	113	202	59	10	–	222	84	35	138	20	20	415	29	41
Buffalo – Rochester	555	143	56	436	110	33	20	10	–	50	10	20	47	13	3	94	7	7
Philadelphia	1,616	216	652	969	160	318	218	20	111	246	20	179	183	16	44	83	8	16
Pittsburgh – Wheeling	2,473	574	729	2,328	526	685	44	13	9	88	35	31	13	–	4	13	–	–
Middle Atlantic	2,807	303	781	2,067	199	556	210	10	56	239	56	118	291	38	51	589	31	43
Baltimore	77	15	9	50	12	3	6			21	3	6	–			44	15	
Southern	3,429	710	434	2,069	492	186	185	56	45	469	84	152	706	78	51	705	175	6
Cleveland – Youngstown	1,242	143	89	974	90	53	53	12	4	81	4	20	134	37	12	163	8	4
Cincinnati – Dayton	430	69	81	296	50	60	42	3	3	34	8	16	58	8	2	39	2	18
Detroit – Toledo	1,015	357	41	653	221	40	28	2	–	17	6	–	317	128	1	104	13	39
Milwaukee	743	120	179	336	74	49	204	18	70	84	21	32	99	7	28	35	4	7
Chicago	2,225	368	115	1,576	215	109	154	26	–	219	77	6	276	50	–	251	40	–
Indianapolis	125	49	–	97	41	–	12	3	–	5	2	–	11	3	–	25	9	2
Midwestern	5,476	772	753	3,907	533	366	534	88	104	699	106	261	336	45	22	4,107	84	68
Minneapolis – St. Paul	124	29	11	98	20	9	2			14	9	2	20			110	15	
St. Louis – Kansas City	849	168	249	745	164	190	16	4	4	22	–	15	66	–	40	157	18	46
Central and Mountain	998	232	105	564	156	48	35	11	7	72	23	11	327	42	39	382	55	22
Houston	116	36	1	104	25	1	3	–	–	11	11	–	–	–	–	30	8	3
Southwestern	877	244	182	568	184	85	85	–	12	151	48	61	73	12	24	110	16	–
San Francisco – Oakland	239	51	97	148	45	58	39	6	15	26	–	13	26	–	13	6	6	–
Los Angeles	588	96	55	424	90	42	42	–	–	71	6	13	51	–	–	67	19	
Pacific	409	107	55	254	63	26	47	15	3	85	23	26	43	6	–	26	–	–
Total	32,159	5,520	5,562	22,830	3,849	3,496	2,496	426	520	3,148	676	1,100	3,685	69	446	5,089	593	324

Mechanical PRESSES



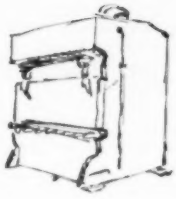
(Standard Commodity Code: 3443 00) Includes all inclinable, single-action for punching, blanking, forming, and light embossing (3443 10); vertical, straight sided and arch frame, single action (but not bulldozers) (3443 20); vertical, gap or C-frame, adjustable bed, and horning, single action (3443 30 & 40); double and triple action presses are included with 3443 10, 20, & 30. All horizontal types, except bulldozers, are listed separately (3443 60); bulldozers and others not elsewhere classified (3443 70 & 90) complete the category.

230,392 machines—61% are at least 10 years old; 31% over 20 years old

	TOTAL MECHANICAL PRESSES			INCLINABLE			VERTICAL C - FRAME			VERTICAL STRAIGHT-SIDED			DIEING MACHINES			HORIZONTAL			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																					
Agricultural Machinery	3,289	934	1,121	837	235	166	1,048	349	484	751	135	256	190	100	–	273	73	125	190	42	90
Constr., Mining, Oil Well	1,012	243	284	421	97	53	200	73	84	214	57	77	3	–	–	77	3	60	97	13	10
Metalworking Machinery	2,844	840	626	1,534	522	221	497	120	161	409	133	151	20	–	8	70	10	15	314	55	70
Special–Industry Mach.	4,200	1,318	1,586	2,528	861	729	624	193	326	552	132	309	77	55	6	55	33	6	364	44	210
General Ind. Equipment	4,566	991	1,586	2,195	528	628	962	228	268	848	77	477	26	11	4	62	11	33	473	136	176
Office and Store Mach.	6,279	1,221	3,166	2,674	480	1,144	2,751	582	1,579	541	81	346	114	33	12	–	–	–	199	45	85
Domestic, Service Equip.	11,988	3,567	3,319	6,273	1,588	1,882	1,850	761	358	2,236	843	392	62	23	15	64	15	39	1,503	337	633
Electrical Equipment	24,806	6,258	6,729	13,385	2,893	3,181	3,224	1,195	949	3,917	1,186	1,199	384	103	76	65	12	14	3,831	869	1,310
Misc. Parts, Jobbing	6,338	2,454	1,007	4,195	1,557	568	357	174	101	1,264	458	311	27	18	–	64	55	–	431	192	27
Motor Vehicles and Parts	26,666	7,338	12,013	8,928	2,635	3,726	5,930	1,488	3,291	7,852	2,134	3,299	62	53	–	636	191	235	3,258	837	1,462
Aircraft and Parts	1,404	236	26	887	191	5	198	12	16	186	18	–	14	–	–	4	4	–	115	11	5
Railroad Equipment	1,578	414	415	378	91	103	295	88	53	652	176	178	63	8	3	61	18	30	129	33	48
Fabricated Metal Prod.	108,332	36,707	32,558	59,329	21,770	13,026	14,584	5,129	5,879	24,793	6,349	10,999	868	277	96	736	238	217	8,022	2,944	2,341
Ships, Ordnance, Misc.	14,319	2,507	3,642	3,438	1,015	741	2,729	565	844	5,491	569	1,517	286	27	85	538	235	81	1,837	96	374
Precision Mechanisms	12,771	3,245	3,355	4,127	875	696	4,446	1,670	1,486	1,570	381	563	274	25	17	70	1	31	2,284	293	642
Total	230,392	68,273	71,433	111,129	35,338	26,869	39,695	12,627	15,799	51,276	12,729	20,074	2,470	733	322	2,775	899	886	23,047	5,947	7,483
BY GEOGRAPHIC AREA																					
Boston	14,015	4,054	5,591	6,167	2,221	1,445	2,601	533	1,760	2,558	670	1,339	157	51	16	90	16	35	2,442	553	996
Bridgeport–Hartford	13,889	3,530	6,908	4,822	1,349	1,667	3,725	1,023	1,920	3,611	829	2,376	247	37	121	65	17	37	1,419	275	787
New England	5,850	1,568	1,780	3,770	1,210	870	733	126	246	798	173	503	185	–	5	24	15	–	340	44	156
New York–Newark	18,656	6,300	4,048	12,100	3,993	2,166	2,749	1,048	862	2,344	787	749	118	39	10	123	39	64	1,222	394	197
Buffalo–Rochester	7,942	3,045	2,385	3,036	1,646	615	2,588	681	865	1,386	468	534	20	10	–	104	33	10	808	207	361
Philadelphia	10,367	3,174	2,637	4,684	2,036	879	1,191	453	425	3,745	605	1,106	48	12	20	107	16	36	592	52	171
Pittsburgh–Wheeling	4,602	991	1,720	2,996	582	1,094	323	75	118	560	198	234	4	4	–	44	13	9	675	119	265
Middle Atlantic	13,368	3,131	3,829	5,807	1,226	1,500	2,772	921	901	2,811	613	1,112	294	31	14	90	21	42	1,594	319	260
Baltimore	428	92	125	189	56	68	168	15	33	59	21	21	3	–	–	3	–	3	6	–	–
Southern	8,981	1,974	2,212	3,696	1,205	706	1,649	410	577	2,343	247	699	219	45	6	116	22	39	958	45	185
Cleveland–Youngstown	12,832	4,188	3,261	6,432	2,262	1,248	2,505	940	894	3,203	759	924	118	24	8	155	69	28	419	134	159
Cincinnati–Dayton	6,446	1,904	1,797	3,560	1,126	927	1,133	349	448	1,299	309	320	16	2	3	48	18	18	390	100	81
Detroit–Toledo	23,046	6,315	10,953	8,640	2,539	3,557	4,908	1,269	2,902	6,572	1,761	3,199	24	15	–	490	133	194	2,412	598	1,101
Milwaukee	3,646	848	1,399	1,373	387	155	524	158	225	1,376	211	843	21	–	14	18	4	14	334	88	148
Chicago	21,518	7,730	5,309	11,855	4,009	2,800	2,349	1,052	650	4,685	1,692	1,107	186	64	19	154	77	32	2,289	836	701
Indianapolis	1,401	437	360	596	193	122	289	51	128	424	175	108	3	2	–	6	5	2	83	11	–
Midwestern	39,604	12,409	11,170	19,399	6,440	4,021	4,376	1,625	1,671	9,384	2,207	3,755	757	388	77	731	279	235	4,977	1,468	1,411
Minneapolis–St. Paul	2,358	485	164	858	245	66	870	186	70	420	45	7	25	2	5	146	5	–	39	2	16
St. Louis–Kansas City	10,640	2,961	4,136	5,282	1,194	2,424	2,029	777	694	1,920	464	689	11	–	4	95	26	51	1,303	500	274
Central and Mountain	3,427	1,298	768	1,514	519	252	1,057	534	252	594	156	204	11	7	–	74	52	15	177	30	45
Houston	138	47	31	8	–	3	8	8	–	58	17	22	–	–	–	6	–	–	58	22	6
Southwestern	1,707	399	279	1,041	242	73	182	48	61	266	85	36	–	–	–	36	24	–	182	–	109
San Francisco–Oakland	1,616	515	267	869	167	77	374	219	58	270	97	116	–	–	–	13	–	3	90	32	13
Los Angeles	3,115	687	283	1,999	347	128	414	106	39	510	128	71	–	–	–	19	6	13	173	100	32
Pacific	800	193	21	456	134	6	178	20	–	80	12	–	3	–	–	18	9	6	65	18	9
Total	230,392	68,273	71,433	111,129	35,338	26,869	39,695	12,627	15,799	51,276	12,729	20,074	2,470	733	322	2,775	899	886	23,047	5,947	7,483

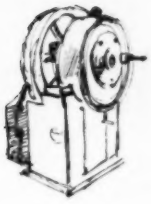
BENDING AND FORMING MACHINES

(Standard Commodity Code: 3441 00) Includes bending rolls, sheet and plate (3441 10 & 20); bending rolls, angles, bars, and shapes, including horizontal and vertical (3441 40); bending brakes and folders, power driven (3441 50); rotary bending and forming machines, power driven, hand operated (3441 60 & 70); rotary forming, pipe and bar bending machines plus all other types not elsewhere classified (3441 90).



52,081 machines—50% are at least 10 years old; 22% over 20 years old

	TOTAL BENDING & FORMING			BENDING ROLLS SHEET & PLATE			BENDING ROLLS BARS & SHAPES			POWER BENDING BRAKES			ROTARY FORMING MACHINES		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	1,647	592	508	564	266	117	128	48	42	460	128	639	114	35	52
Construction, Mining, Oil Well	1,017	327	231	387	147	114	100	43	10	300	80	47	37	10	10
Metalworking Machinery	971	199	188	248	78	75	63	10	20	281	45	35	50	8	5
Special-Industry Machinery	2,495	750	822	707	237	282	237	28	149	502	171	66	193	121	22
General Industrial Equipment	2,495	573	757	657	180	246	231	55	92	639	125	125	139	48	37
Office and Store Machines	447	138	138	73	4	37	12	–	12	69	8	4	–	–	–
Domestic and Service Equip.	2,295	776	280	586	181	97	91	32	12	768	305	96	224	58	40
Electrical Equipment	3,211	793	530	959	252	237	133	33	31	978	260	100	204	79	21
Misc. Machine Parts, Jobbing	1,394	403	358	495	147	183	147	64	18	284	73	37	110	27	37
Motor Vehicles and Parts	3,471	1,112	859	826	274	213	493	151	15	564	151	145	188	41	91
Aircraft and Parts	1,541	186	21	285	40	4	140	19	4	379	74	4	127	9	–
Railroad Equipment	742	165	188	126	32	50	85	20	13	262	55	33	68	20	25
Fabricated Metal Products	22,879	6,972	4,414	5,179	1,681	1,321	2,074	488	897	7,023	1,759	694	2,970	789	659
Shipbuilding, Ordnance, Misc.	5,336	1,419	1,414	1,555	321	668	394	56	95	735	209	95	376	113	61
Precision Mechanisms	2,140	451	562	536	101	233	122	13	71	310	88	20	99	1	3
Total	52,081	14,856	11,270	13,193	3,941	3,877	4,450	1,060	1,481	13,554	3,531	1,639	4,899	1,359	1,063
BY GEOGRAPHIC AREA															
Boston	2,278	490	791	541	145	204	176	55	106	566	106	74	136	20	27
Bridgeport-Hartford	1,044	163	206	306	62	81	37	6	6	180	25	28	116	28	6
New England	948	209	466	233	68	117	122	–	87	136	58	24	102	24	29
New York-Newark	3,089	839	602	670	261	246	237	64	59	1,117	248	138	292	49	59
Buffalo-Rochester	1,483	460	323	341	120	37	124	33	33	240	87	37	33	20	10
Philadelphia	2,632	557	843	808	206	316	496	111	175	592	111	48	95	12	16
Pittsburgh-Wheeling	1,453	371	691	379	141	132	556	106	392	331	75	79	79	22	44
Middle Atlantic	3,625	659	998	748	149	312	198	49	45	884	163	97	551	108	111
Baltimore	188	37	15	36	9	15	6	–	–	104	24	–	–	–	–
Southern	5,916	2,314	853	1,305	625	455	255	73	128	1,014	312	118	480	170	34
Cleveland-Youngstown	1,942	531	249	407	151	69	163	41	12	666	179	90	210	20	8
Cincinnati-Dayton	1,071	232	194	379	92	95	156	24	2	209	43	39	60	16	14
Detroit-Toledo	2,855	758	689	488	145	155	227	86	8	404	103	115	121	27	62
Milwaukee	872	256	212	341	106	113	102	28	18	165	56	21	39	4	7
Chicago	5,336	1,874	677	1,037	367	235	412	86	111	1,557	463	109	820	302	84
Indianapolis	378	97	46	87	31	14	16	–	3	67	20	11	17	3	6
Midwestern	6,421	2,778	1,976	2,215	599	571	510	127	164	2,600	911	361	1,222	418	459
Minneapolis-St. Paul	448	87	150	157	32	30	41	5	16	138	14	61	57	25	7
St. Louis-Kansas City	1,271	337	267	354	84	142	37	15	11	364	88	44	85	18	4
Central and Mountain	1,747	655	270	472	268	69	104	10	22	489	141	33	93	37	26
Houston	39	31	3	11	8	–	3	–	1	8	–	–	3	3	–
Southwestern	2,486	448	521	762	109	266	210	48	61	805	97	61	147	12	48
San Francisco-Oakland	676	213	233	251	77	129	45	26	12	206	58	26	26	–	19
Los Angeles	1,355	282	78	347	103	45	132	29	–	462	96	22	45	6	3
Pacific	1,090	178	65	254	53	35	85	18	9	250	53	3	70	15	–
Total	52,081	14,856	11,270	13,193	3,941	3,877	4,450	1,060	1,481	13,554	3,531	1,669	4,899	1,359	1,063



SWAGING MACHINES
WIRE AND STRIP FORMING MACHINES

Swaging machines (Standard Commodity Code: 3445 40) include, in one comprehensive group, all machines of this type.

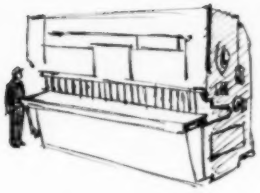
4,739 machines—60% are at least 10 years old; 32% over 20 years old

Wire and strip forming machines (Standard Commodity Code: 3446 00) include all types of machines falling into this category, but not roll forming.

13,687 machines—67% are at least 10 years old; 30% over 20 years old

BENDING MACHINES PIPE AND BAR			OTHER				SWAGING MACHINES (NOT IN TOTAL)			WIRE & STRIP FORMING MACHINES (NOT IN TOTAL)		
TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR		TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
						BY INDUSTRY						
121	35	38	260	80	121	Agricultural Machinery	17	3	10	45	7	35
130	20	37	63	27	13	Construction, Mining, Oil Well	13	3	7	48	–	33
158	28	15	171	30	38	Metalworking Machinery	55	–	10	53	5	–
298	66	55	558	127	248	Special-Industry Machinery	199	61	138	331	28	270
418	84	62	411	81	195	General Industrial Equipment	62	18	4	231	29	172
45	16	8	248	110	77	Office and Store Machines	126	24	81	118	57	33
143	149	20	483	51	15	Domestic and Service Equip.	250	82	15	360	186	23
243	62	29	694	107	112	Electrical Equipment	356	84	70	1,792	584	467
211	37	46	147	55	37	Misc. Machine Parts, Jobbing	220	18	92	73	27	–
124	19	25	1,276	476	370	Motor Vehicles and Parts	140	67	24	439	130	157
260	19	2	350	25	7	Aircraft and Parts	120	9	–	64	2	–
91	13	42	100	25	25	Railroad Equipment	25	2	5	13	3	8
1,920	517	290	3,713	1,738	553	Fabricated Metal Products	1,595	651	494	9,581	4,020	2,753
981	228	121	1,295	492	374	Shipbuilding, Ordnance, Misc.	546	77	69	345	95	54
311	83	56	762	165	179	Precision Mechanisms	1,015	396	453	194	–	100
5,454	1,376	846	10,531	3,589	2,364	Total	4,739	1,405	1,472	13,687	5,167	4,105
						BY GEOGRAPHIC AREA						
263	74	55	596	90	325	Boston	868	165	474	333	214	241
214	14	51	191	28	34	Bridgeport-Hartford	65	6	28	1,058	249	532
97	15	29	258	44	180	New England	219	63	126	460	34	209
282	59	39	491	158	59	New York-Newark	322	133	35	3,483	1,157	788
37	10	7	708	190	199	Buffalo-Rochester	327	187	37	43	23	–
234	32	36	377	79	250	Philadelphia	260	40	128	239	144	75
44	18	13	62	9	31	Pittsburgh-Wheeling	101	26	49	585	186	198
492	59	115	752	160	218	Middle Atlantic	294	128	80	633	290	228
18	9	–	24	9	–	Baltimore	9	–	–	3	–	–
679	277	45	1,933	857	73	Southern	78	34	11	801	485	22
262	49	33	234	81	37	Cleveland-Youngstown	131	4	20	1,424	766	342
26	5	2	242	53	42	Cincinnati-Dayton	56	21	3	798	77	68
98	12	19	1,037	385	330	Detroit-Toledo	126	39	40	425	103	131
102	25	18	123	39	35	Milwaukee	46	7		14	–	–
392	109	19	1,118	547	139	Chicago	270	125	129	902	429	303
36	12	6	95	31	6	Indianapolis	5	3	–	57	6	–
952	268	191	922	455	230	Midwestern	740	293	239	2,774	845	584
41	11	11	14	–	5	Minneapolis-St. Paul	14	7	7	5	2	–
173	55	40	233	77	26	St. Louis-Kansas City	109	45	31	120	31	
232	74	41	377	165	89	Central and Mountain	148	85	7	74	19	
–	–	–	14	–	3	Houston	3	3	–	–	–	
376	121	73	186	61	12	Southwestern	–	–	–			
71	26	–	77	26	26	San Francisco-Oakland	26		6	32	–	–
154	19		215	29	6	Los Angeles	61	3	10	28	19	–
179	23	3	252	16	15	Pacific	93	6	–	12	–	–
5,454	1,396	846	10,531	3,589	2,364	Total	4,739	1,405	1,472	13,687	5,167	4,105

PUNCHING AND SHEARING

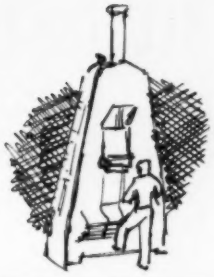


(Standard Commodity Code: 3444 00) Includes punching machines (3444 50); plate, sheet, and alligator type shears (3444 10); bar and angle shears, power driven and hand operated; all rotary types except rolling mill gang disk (3444 20 & 30); all types not otherwise classified (3444 80 & 90).

59,014 machines—59% are at least 10 years old; 30% over 20 years old

	TOTAL PUNCHING AND SHEARING MACHINES			PUNCHING MACHINES			PLATE & SHEET SHEARS			BAR & ANGLE SHEARS			ROTARY SHEARS			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	2,041	543	961	903	135	581	550	176	201	294	59	131	173	90	48	121	83	–
Construction, Mining, Oil Well	1,614	424	799	601	134	361	521	120	204	251	77	114	134	43	53	107	50	47
Metalworking Machinery	919	331	263	264	83	90	397	120	95	113	38	38	60	20	20	85	40	20
Special-Industry Machinery	2,887	983	977	1,165	442	386	949	287	293	304	132	66	204	83	72	265	39	160
General Industrial Equip	2,562	612	976	1,050	242	510	837	176	246	308	88	128	213	55	66	154	51	26
Office and Store Machines	406	122	154	28	4	24	305	110	81	4	–	4	41	4	33	28	4	12
Domestic and Service Equip	1,858	546	400	512	157	96	1,115	314	269	74	20	14	106	31	18	51	24	3
Electrical Equipment	5,375	1,693	1,167	1,464	719	167	2,085	630	445	363	59	88	309	76	95	1,154	207	374
Misc. Machine Parts, Jobbing	1,026	367	229	238	110	92	440	92	55	174	101	27	137	64	37	37	–	18
Motor Vehicles and Parts	4,309	1,541	1,481	2,450	958	794	1,234	315	502	150	51	48	85	24	43	390	193	94
Aircraft and Parts	1,446	185	27	448	48	9	634	92	16	40	9		96	9	2	228	27	–
Railroad Equipment	1,150	167	757	521	70	423	387	60	178	129	25	96	70	27	37	43	5	23
Fabricated Metal Products	23,814	7,275	6,924	8,357	2,656	3,076	9,316	2,798	1,976	1,975	524	780	2,573	801	836	1,593	496	256
Shipbuilding, Ordnance, Misc.	7,031	1,599	2,342	2,366	445	1,047	2,364	567	661	1,165	338	488	407	135	111	731	114	235
Precision Mechanisms	2,574	406	825	1,176	92	594	861	226	129	62	3	37	186	26	48	289	57	17
Total	59,014	16,562	18,484	21,543	6,295	8,270	21,995	5,883	5,351	5,406	1,524	2,059	4,794	1,490	1,519	5,276	1,390	1,285
BY GEOGRAPHIC AREA																		
Boston	1,232	507	834	968	290	298	1,588	351	270	153	39	55	339	88	125	184	39	86
Bridgeport – Hartford	1,228	177	495	464	37	253	451	81	143	98	20	56	91	14	8	124	25	25
New England	1,059	281	471	194	58	73	520	131	209	92	29	53	83	19	49	170	44	87
New York – Newark	4,273	1,112	1,036	1,814	415	577	1,314	286	182	271	108	74	440	138	99	434	165	104
Buffalo – Rochester	1,573	561	244	865	401	73	448	110	127	50	17	7	63	3	27	147	30	10
Philadelphia	3,347	839	1,033	1,187	369	433	1,315	282	296	369	60	159	222	67	87	254	52	60
Pittsburgh – Wheeling	1,525	463	524	370	123	185	366	141	110	172	62	79	194	44	9	423	93	141
Middle Atlantic	3,986	803	1,669	1,067	184	573	1,432	349	516	504	83	229	396	87	132	587	97	219
Baltimore	264	37	83	77	24	32	154	18	50	18	9		9	6		6	–	–
Southern	5,305	1,865	1,517	1,898	562	837	2,093	776	371	522	170	180	399	180	101	393	157	28
Cleveland – Youngstown	2,915	971	765	1,368	521	366	1,042	299	204	204	57	53	247	70	105	134	24	37
Cincinnati – Dayton	861	199	236	285	81	84	378	92	119	19	5	10	42	16	14	37	5	11
Detroit – Toledo	2,641	904	946	1,189	477	431	974	211	392	105	38	31	62	16	33	311	162	58
Milwaukee	1,038	237	412	232	56	95	387	120	120	106	4	49	116	25	46	197	32	102
Chicago	5,238	1,639	1,607	1,885	662	907	1,988	553	405	471	129	109	338	166	64	556	129	122
Indianapolis	322	102	87	142	41	62	142	45	17	12	3	6	17	8	2	9	5	–
Midwestern	9,282	2,667	3,498	2,990	918	1,357	3,679	1,145	1,126	1,084	393	552	871	302	320	758	209	143
Minneapolis – St. Paul	611	105	219	333	32	191	163	39	36	39	11	5	45	18	7	11	5	–
St. Louis – Kansas City	2,066	369	936	1,240	380	639	620	142	230	73	11	29	100	29	51	33	7	7
Central and Mountain	1,906	553	449	600	160	182	813	226	119	194	56	78	220	85	70	82	26	–
Houston	64	12	17	3	–	–	28	–	11	16	–	6	6	6	–	11	6	–
Southwestern	2,634	739	750	1,033	460	327	662	98	97	606	145	169	219	–	145	114	36	12
San Francisco – Los Angeles	882	329	373	186	155	200	283	116	90	77	6	45	64	39	19	52	13	19
Los Angeles	1,262	266	145	395	64	58	610	151	64	56	16	10	138	35	3	64	–	10
Pacific	1,440	337	106	558	105	46	528	121	48	96	53	15	73	29	3	185	29	4
Total	59,014	16,592	18,484	21,543	6,295	8,270	21,995	5,883	5,351	5,406	1,524	2,059	4,794	1,490	1,519	5,276	1,390	1,285

FORGING MACHINERY except presses



(Standard Commodity Code: 3445 00) Includes hammers, steam or air (3445 10); hammers, gravity drop and helve (3445 20); forging machines such as hot and cold headers, upsetting machines, and rolls (3445 30); all others not elsewhere classified, plus swaging machines (3445 40, 50 & 90).

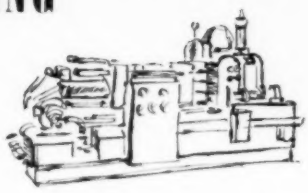
24,195 machines—72% are at least 10 years old; 51% over 20 years old

	TOTAL FORGING MACHINERY (EXCEPT PRESSES)			HAMMERS STEAM OR AIR			HAMMERS GRAVITY DROP			HAMMERS HELVE			FORGING MACHINES (HEADERS) AND ROLLS			OTHER		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	1,224	321	703	93	14	55	450	114	287	190	93	87	256	83	111	235	17	163
Construction, Mining, Oil Well	570	144	350	284	90	160	53	17	33	80	7	70	73	13	37	80	17	50
Metalworking Machinery	540	101	306	201	43	120	146	35	50	100	73	78	45	5	35	48	5	23
Special – Industry Machinery	844	160	635	237	44	177	171	11	138	182	17	154	127	22	105	127	66	61
General Industrial Equipment	293	47	162	161	18	114	26	4	22	37	7	11	18	–	–	51	18	15
Office and Store Machines	60	–	52	8	–	4	28	–	24	4	–	4	20	–	20	–	–	–
Domestic and Service Equip.	210	17	109	56	7	5	56	–	44	40	3	30	35	3	25	23	4	5
Electrical Equipment	552	97	230	131	31	79	129	17	40	92	32	26	83	12	52	112	5	33
Misc. Machine Parts, Jobbing	888	356	146	101	27	64	46	18	27	73	9	–	650	293	46	18	9	9
Motor Vehicles and Parts	1,765	462	800	785	225	349	102	19	55	50	13	18	507	89	295	321	116	83
Aircraft and Parts	575	128	2	235	37	2	173	42	–	11	–	–	44	19	–	112	30	–
Railroad Equipment	395	33	309	191	20	153	68	5	53	30	–	28	88	8	60	18	–	15
Fabricated Metal Products	8,487	1,928	4,610	637	151	392	2,234	590	1,154	793	217	500	4,160	673	2,425	663	297	139
Shipbuilding, Ordnance, Misc.	7,512	1,371	3,696	2,771	229	1,322	2,199	415	1,262	634	154	408	1,371	498	484	537	75	220
Precision Mechanisms	280	67	119	34	–	17	105	22	82	3	–	3	135	45	17	3	–	–
Total	24,195	5,232	12,229	5,930	936	3,013	5,986	1,309	3,271	2,319	565	1,417	7,612	1,763	3,712	2,348	659	816
BY GEOGRAPHIC AREA																		
Boston	2,063	371	1,071	429	37	125	849	158	455	219	12	191	448	140	245	118	24	55
Bridgeport – Hartford	2,142	464	1,462	171	22	79	655	152	515	114	8	83	1,061	237	748	141	45	37
New England	567	54	395	53	5	34	187	10	123	122	5	97	93	15	49	112	19	92
New York – Newark	628	197	159	178	20	54	184	78	65	5	–	5	119	5	25	142	94	10
Buffalo – Rochester	174	36	47	37	23	10	73	–	20	7	–	7	27	13	3	30	–	7
Philadelphia	1,555	217	752	418	34	171	231	48	111	142	24	80	569	75	275	195	36	115
Pittsburgh – Wheeling	1,214	218	757	146	13	119	77	4	18	150	18	110	788	179	484	53	4	26
Middle Atlantic	1,993	241	1,267	586	49	430	773	112	523	151	21	99	398	38	173	85	21	42
Baltimore	127	33	9	62	21	6	62	12	–	3	–	3	–	–	–	–	–	–
Southern	1,531	435	786	566	160	302	339	150	151	170	34	120	247	72	157	209	19	56
Cleveland – Youngstown	1,545	422	500	385	37	170	133	24	29	155	33	91	660	275	206	212	53	4
Cincinnati – Dayton	183	40	42	48	10	18	108	27	6	3	–	3	19	–	13	5	3	2
Detroit – Toledo	1,487	344	694	673	151	313	99	13	50	31	10	7	476	87	276	208	83	48
Milwaukee	239	50	110	116	28	60	49	7	11	14	4	11	49	11	21	11	–	7
Chicago	2,075	272	1,205	512	102	325	370	64	284	184	68	91	847	32	441	162	6	64
Indianapolis	89	33	6	25	11	6	20	6	–	11	5	–	–	–	–	33	11	–
Midwestern	4,296	1,247	2,258	640	62	427	1,225	309	502	693	270	351	1,534	514	527	204	92	151
Minneapolis – St. Paul	177	6	98	36	–	25	57	2	43	5	2	–	14	–	5	65	2	26
St. Louis – Kansas City	295	69	128	152	22	88	26	7	11	18	18	–	73	15	18	26	7	11
Central and Mountain	422	86	127	159	38	30	96	11	45	41	11	19	77	11	7	49	15	26
Houston	41	9	24	18	–	14	14	6	6	–	–	–	6	3	1	3	–	3
Southwestern	329	85	109	171	36	85	36	13	–	24	–	24	–	–	–	98	36	–
San Francisco – Oakland	233	90	116	71	6	58	39	26	–	32	13	13	39	13	26	52	32	19
Los Angeles	340	79	76	119	6	48	83	35	3	16	6	6	42	19	6	80	13	12
Pacific	450	134	31	159	43	16	201	35	–	9	3	6	26	9	6	55	44	3
Total	24,195	5,232	12,229	5,930	936	3,013	5,986	1,309	3,271	2,319	565	1,417	7,612	1,763	3,712	2,348	659	816

DIE CASTING, PLASTIC MOLDING

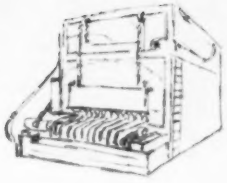
(Standard Commodity Code: 3191 11 & 12) All types of injection and compression plastic molding equipment, which total 8360, with 33% at least 10 years old; 6% over 20 years old.

Includes hot- and cold-chamber type die casting machines, which total 8258, with 17% at least 10 years old; 5% over 20 years old.



	TOTAL DIE CASTING			HOT CHAMBER			COLD CHAMBER			TOTAL PLASTIC MOLDING			INJECTION			COMPRESSION		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Construction Mining Oil Refin.	13	—	—	13	—	—	—	—	—	7	—	—	—	—	—	7	—	—
Metalworking Machinery	33	3	—	28	3	—	5	—	—	58	15	—	28	—	—	30	15	—
Special-Industry Machinery	17	17	—	—	—	—	17	17	—	453	326	—	33	17	—	420	309	—
General Industrial Equipment	23	7	4	22	7	4	4	—	—	77	22	—	18	—	—	59	22	—
Office and Store Machines	216	—	163	212	—	163	4	—	—	216	118	4	53	—	—	163	118	4
Domestic and Service Equip.	164	55	12	115	41	3	49	14	9	276	38	—	59	—	—	217	38	—
Electrical Equipment	547	87	29	442	57	19	105	30	10	2,613	445	150	280	5	—	2,333	440	150
Misc. Machine Parts, Tooling	348	64	46	230	64	46	15	—	—	64	55	—	9	—	—	55	55	—
Motor Vehicles and Parts	405	151	64	330	109	42	103	42	22	242	61	23	44	18	1	198	43	22
Aircraft and Parts	24	—	—	9	—	—	15	—	—	23	2	—	5	—	—	18	2	—
Railroad Equipment	2	—	—	—	—	—	2	—	—	8	3	—	8	3	—	—	—	—
Fabricated Metal Products	782	199	26	598	114	26	187	85	—	2,780	1,098	301	1,450	209	—	2,330	889	301
Shipbuilding, Ordnance, Misc.	3,518	303	33	2,156	259	27	3,362	244	6	65	32	—	15	4	—	52	28	—
Precision Mechanisms	130	—	1	87	—	—	43	—	1	475	67	—	317	17	—	158	50	—
Total	8,258	1,068	378	4,342	656	330	3,916	412	48	8,360	2,282	478	2,319	273	1	6,041	2,009	477
BY GEOGRAPHIC AREA																		
Boston	394	20	31	159	8	—	235	12	11	1,029	159	—	194	—	—	835	159	—
Bridgeport–Hartford	524	59	12	134	17	3	390	42	3	762	287	42	272	44	—	550	163	42
New England	335	—	—	23	—	—	312	—	—	377	35	—	207	20	2	170	15	—
New York–Newark	2,657	232	—	1,259	100	—	1,398	132	—	1,647	458	115	484	42	—	1,163	416	115
Buffalo–Rochester	204	63	33	167	60	33	37	3	—	134	17	—	30	—	—	104	17	—
Philadelphia	227	40	4	117	44	4	112	4	—	170	—	28	40	—	—	131	—	28
Pittsburgh–Wheeling	57	40	18	57	40	18	—	—	—	386	187	93	—	—	—	286	187	93
Middle Atlantic	384	—	33	260	—	10	124	—	3	567	294	35	7	—	—	560	294	35
Baltimore	—	—	—	—	—	—	—	—	—	12	—	—	3	—	—	9	—	—
Cincinnati	124	—	—	11	—	—	113	—	—	228	52	64	53	22	—	175	30	64
Cleveland–Youngstown	670	58	138	534	58	138	137	—	—	155	4	4	140	—	—	145	4	4
Cincinnati–Dayton	107	—	33	81	—	33	26	—	—	57	12	—	24	—	—	33	12	—
Detroit	838	109	42	650	51	38	179	58	4	1,007	339	13	70	30	1	937	309	12
Milwaukee	4	—	—	4	—	—	—	—	—	18	—	—	30	—	—	18	—	—
Chicago	663	19	—	537	19	—	126	—	—	1,074	53	—	1,039	38	—	35	15	—
Milwaukee–Chicago	19	5	—	14	5	—	5	—	—	4	—	—	2	—	—	2	—	—
Minneapolis	436	200	65	444	151	59	112	49	6	807	414	—	540	84	—	339	317	—
Minneapolis–St. Paul	31	—	—	8	—	—	23	—	—	34	10	—	4	10	—	30	21	—
St. Louis–Kansas City	134	127	2	114	77	24	120	111	2	111	114	64	—	—	—	111	114	62
Central and Western	19	4	—	19	3	—	—	1	—	23	—	—	3	—	—	19	—	—
Missouri	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kansas	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Southwestern	72	—	—	72	—	—	—	—	—	72	24	—	72	24	—	—	—	—
San Francisco–Los Angeles	19	19	—	—	—	—	19	19	—	122	—	—	122	—	—	—	—	—
Los Angeles	120	—	3	57	—	3	63	—	—	211	53	53	2	—	1	209	53	52
Pacific	—	—	—	—	—	—	—	—	—	6	—	—	6	—	—	—	—	—
Total	8,258	1,068	378	4,342	656	330	3,916	412	48	8,360	2,282	478	2,319	273	1	6,041	2,009	477

Materials Heating Equipment



(Standard Commodity Code: 3471 00, 3475 00) Includes heat-treating and stock-heating furnaces, salt baths, induction heating units, baking and drying ovens, plus flame-hardening machines.

106,342 units—29% are at least 10 years old: 14% over 20 years old.

	TOTAL MATERIALS HEATING EQUIPMENT			HEAT-TREATING FURNACES			STOCK-HEATING FURNACES			SALT BATHS			INDUCTION HEATING UNITS			BAKING AND DRYING OVENS			FLAME HARDENING		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																					
Agricultural Machinery	3,252	1,201	557	1,190	363	173	1,460	723	253	107	35	10	270	17	–	142	28	21	83	34	–
Constr, Mining, Oil Well	2,949	818	538	1,737	518	341	474	157	134	284	63	–	94	7	20	310	69	46	378	40	3
Metalworking Machinery	6,163	1,414	1,109	3,893	1,072	665	557	78	236	705	128	70	291	13	–	418	90	88	248	33	50
Special-Industry Mach	3,599	983	530	2,191	635	354	320	138	77	502	99	55	144	17	–	293	66	33	149	26	11
General Ind. Equip.	3,687	900	450	2,341	606	327	279	81	29	352	81	38	176	4	7	407	125	62	88	11	7
Office and Store Mach	1,506	309	240	635	163	102	77	24	4	216	33	24	73	4	–	436	78	94	49	12	16
Domestic, Service Equip	2,833	717	226	1,479	362	107	224	58	48	110	24	5	100	2	–	832	265	56	28	5	8
Electrical Equipment	14,058	2,761	1,319	4,592	1,043	432	1,862	276	350	394	72	14	1,357	16	2	5,004	1,325	504	54	9	17
Misc. Mach. Parts, Job	5,422	1,392	603	4,269	1,227	548	128	46	37	692	92	18	137	–	–	119	18	–	73	9	–
Motor Vehicles and Pts	8,040	2,384	1,278	5,616	1,510	993	717	282	115	224	97	14	278	1	179	1,109	491	16	17	3	–
Aircraft and Parts	2,183	196	9	1,327	141	7	181	7	–	165	15	–	155	–	–	311	53	2	64	–	–
Railroad Equipment	1,405	321	460	465	120	58	702	174	370	22	2	3	45	–	3	108	29	16	13	2	
Fabricated Metal Prod	25,517	7,374	3,138	12,687	3,868	1,422	3,973	1,332	911	1,988	530	178	1,024	26	–	5,015	1,541	589	490	67	38
Ships, Ordnance, Misc	20,689	4,315	4,211	8,867	1,648	1,556	6,436	1,574	1,759	883	109	47	1,091	28	3	2,132	918	798	280	38	52
Precision Mechanisms	5,009	1,135	469	2,389	621	297	363	58	65	419	45	–	187	3	–	1,041	372	63	260	36	44
Total	106,342	26,228	14,937	53,678	13,897	7,181	17,753	5,008	4,496	7,067	1,425	452	5,482	169	174	20,296	5,401	2,386	2,066	328	248
BY GEOGRAPHIC AREA																					
Boston	9,155	1,920	1,134	3,989	1,029	443	2,089	282	412	496	118	35	782	12	4	1,607	455	180	192	24	60
Bridgeport – Hartford	4,653	1,023	1,046	2,436	509	579	672	219	256	479	115	48	253	3	–	717	166	146	96	11	17
New England	3,446	676	482	1,853	360	306	253	83	49	335	73	15	209	–	–	758	141	107	58	19	5
New York – Newark	7,225	1,897	548	4,329	1,189	379	389	158	58	531	74	26	389	13	16	1,429	437	58	158	26	11
Buffalo – Rochester	2,256	516	151	1,473	411	84	174	37	20	104	7	7	67	7	–	291	37	13	147	17	27
Philadelphia	4,691	1,008	735	2,662	690	401	429	79	178	369	52	36	365	12	–	806	167	115	60	8	8
Pittsburgh – Wheeling	3,353	1,190	574	1,138	490	159	516	207	84	146	84	9	75	13	–	1,469	392	322	9	4	–
Middle Atlantic	9,328	2,044	1,567	4,104	995	568	1,748	491	704	551	87	28	394	17	7	2,423	430	232	108	24	28
Baltimore	400	89	15	246	77	12	53	–	–	30	–	–	21	–	–	47	12	3	7	–	–
Southern	9,264	2,745	861	2,926	736	282	2,241	754	253	652	102	–	254	12	–	3,075	1,329	326	116	12	–
Cleveland – Youngstown	6,391	997	710	3,646	649	373	924	90	265	540	73	28	621	12	8	285	65	8	175	8	8
Cincinnati – Dayton	1,433	302	201	1,042	258	114	65	21	16	79	10	10	27	2	–	161	8	26	58	3	27
Detroit – Toledo	5,627	1,379	1,043	3,912	901	742	495	139	97	175	20	10	237	7	116	987	312	77	21	4	1
Milwaukee	2,129	473	401	1,007	218	144	436	106	158	56	11	4	116	14	14	468	106	77	46	18	4
Chicago	7,958	2,226	1,044	4,281	1,435	550	1,439	270	392	409	64	19	338	–	–	1,427	444	77	64	13	6
Indianapolis	715	183	30	590	139	16	44	11	2	34	3	–	2	–	–	75	30	12	–	–	–
Midwestern	10,003	3,040	3,361	5,645	2,303	1,410	4,274	1,621	1,254	1,147	249	151	940	17	9	2,558	584	499	439	86	40
Minneapolis – St. Paul	806	240	58	295	66	5	119	25	47	30	9	–	47	2	–	321	136	5	86	–	–
St. Louis – Kansas City	2,018	443	255	1,269	299	102	252	62	93	121	11	7	10	–	–	237	69	51	18	4	–
Central and Mountain	2,234	662	241	1,022	319	119	371	111	71	250	78	11	68	7	–	415	152	45	59	15	4
Boston	754	269	190	519	218	147	58	17	6	50	12	–	71	11	–	7	3	–	8	3	–
Southeastern	1,144	255	121	633	157	73	173	36	48	169	24	–	28	–	–	242	48	–	73	–	–
San Francisco – Oakland	799	265	143	374	97	142	251	116	6	71	13	–	–	–	–	71	26	–	13	13	–
Los Angeles	1,315	368	23	809	218	18	205	61	–	138	3	–	64	6	–	295	35	6	59	13	–
Pacific	766	118	21	304	59	15	82	12	3	117	23	–	68	6	–	125	15	3	20	3	–
Total	106,342	26,228	14,937	53,678	13,897	7,181	17,753	5,008	4,496	7,067	1,425	452	5,482	169	174	20,296	5,401	2,386	2,066	328	248

PLATING, BALANCING, RIVETING

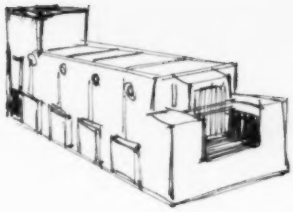
(Standard Commodity Code: 3472 00 for electroplating) Includes machines (3472 10); tanks (3472 11) and barrels (3472 12).
47,176 units—28% are at least 10 years old; 4% over 20 years old

(Standard Commodity Code: 3463 00) Includes all types of static, dynamic, combination, and special balancing machines, which total 5868 of which 38% are at least 10 years old; 11% over 20 years old

(Standard Commodity Code: 3474 00) Includes all types of non-portable riveting machines such as helve, rotary, spinning, and squeeze.
33,283 machines—39% are at least 10 years old; 18% over 20 years old

	TOTAL PLATING EQUIPMENT			MACHINES			TANKS			BARRELS			BALANCING MACHINES (NOT IN TOTAL)			RIVETING MACHINES (NOT PORTABLE) (NOT IN TOTAL)		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	107	20	–	17	3	–	66	14	–	24	3	–	97	10	3	754	263	194
Construction, Mining, Oil Well	177	13	–	47	10	–	120	3	–	10	–	–	80	27	7	217	53	53
Metalworking Machinery	412	106	20	68	3	–	311	95	20	33	8	–	379	68	50	397	55	63
Special-Industry Machinery	1,132	409	11	83	11	–	867	327	11	182	61	–	403	99	61	878	221	331
General Industrial Equipment	520	113	29	73	7	7	374	84	15	73	22	7	466	88	37	756	143	341
Office and Store Machines	1,848	561	40	106	12	12	1,420	480	–	322	69	28	41	12	4	2,389	509	924
Domestic and Service Equip.	879	169	55	218	45	12	507	96	29	154	28	14	334	99	13	1,743	534	204
Electrical Equipment	8,601	1,373	125	471	93	24	6,544	896	65	1,586	384	36	611	117	95	7,614	1,174	374
Misc. Machine Parts, Jobbing	421	119	18	73	18	–	238	64	–	110	37	18	302	73	27	916	192	256
Motor Vehicles and Parts	2,300	899	317	76	42	1	1,848	643	295	376	214	21	1,234	519	230	3,343	1,444	422
Aircraft and Parts	1,417	52	–	90	–	–	1,228	48	–	99	4	–	228	9	11	1,975	93	2
Railroad Equipment	65	5	17	7	–	3	28	–	7	30	5	7	91	15	15	188	8	111
Fabricated Metal Products	19,576	5,367	1,260	1,712	327	250	12,025	3,256	653	5,839	1,784	357	674	137	23	9,667	2,455	2,150
Shipbuilding, Ordnance, Misc.	3,601	1,117	138	405	78	7	3,057	960	121	139	79	–	681	184	146	752	203	168
Precision Mechanisms	6,120	723	147	193	18	37	5,200	605	85	727	100	25	247	23	20	1,694	351	117
Total	47,176	11,046	2,177	3,639	667	353	33,833	7,581	1,311	9,704	2,798	513	5,868	1,480	742	33,283	7,698	5,710
BY GEOGRAPHIC AREA																		
Boston	3,430	825	159	292	55	12	2,462	468	147	676	302	–	380	86	63	1,258	282	347
Bridgeport–Hartford	4,871	1,400	275	330	31	56	3,391	840	188	1,150	529	31	270	25	17	1,506	309	533
New England	1,154	134	106	34	5	–	889	119	106	231	10	–	170	29	39	447	122	136
New York–Newark	5,487	1,389	126	247	21	–	3,509	952	16	1,731	416	110	255	74	49	2,530	773	495
Buffalo–Rochester	1,119	340	74	94	10	7	731	267	47	294	63	20	281	70	10	2,235	244	157
Philadelphia	2,030	621	95	119	28	8	1,409	514	83	502	79	4	266	76	64	1,386	262	362
Pittsburgh–Wheeler	915	217	49	185	71	31	527	106	9	193	40	9	150	57	26	216	40	123
Middle Atlantic	3,774	710	76	274	35	17	2,881	516	14	619	159	45	349	69	57	1,819	298	409
Baltimore	556	12	–	62	–	–	456	12	–	38	–	–	21	–	6	477	80	9
Southern	2,380	974	51	331	39	–	2,775	929	45	274	6	6	258	90	6	1,502	230	257
Cleveland–Youngstown	2,926	532	94	348	24	33	2,091	363	53	487	145	8	403	53	16	916	195	214
Cincinnati–Dayton	356	70	16	39	11	5	269	45	–	48	14	11	171	55	3	1,177	217	283
Detroit–Toledo	2,361	569	294	60	37	–	1,987	354	275	314	178	19	852	266	208	1,728	532	458
Milwaukee	698	102	43	70	7	4	494	74	32	134	21	7	253	39	49	655	106	70
Chicago	4,394	814	158	229	19	13	3,315	546	132	850	249	13	286	109	19	4,170	694	685
Indianapolis	192	14	–	47	2	–	126	12	–	19	–	–	5	2	–	198	48	6
Midwestern	5,427	1,620	513	480	160	160	3,469	996	145	1,478	464	208	904	271	69	5,036	1,168	673
Minneapolis–St. Paul	289	84	5	34	7	–	132	34	5	123	43	–	24	–	–	295	86	7
St. Louis–Kansas City	334	65	29	30	–	–	227	47	7	77	18	22	219	84	37	2,216	1,375	253
Central and Mountain	1,054	300	11	143	76	4	655	200	7	256	22	–	113	22	4	571	156	108
Houston	110	33	–	19	8	–	66	8	–	25	17	–	11	3	–	12	6	–
Southwestern	375	205	–	85	24	–	266	169	–	24	12	–	86	12	–	278	73	97
San Francisco–Oakland	283	–	–	6	–	–	225	–	–	52	–	–	45	–	–	322	129	19
Los Angeles	1,458	13	–	45	–	–	1,339	10	–	74	3	–	67	16	–	1,416	119	–
Pacific	203	3	3	36	–	3	132	–	–	35	3	–	29	12	–	917	54	9
Total	47,176	11,046	2,177	3,639	667	353	33,833	7,581	1,311	9,704	2,798	513	5,868	1,480	742	33,283	7,698	5,710

CLEANING EQUIPMENT

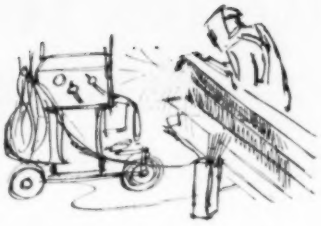


Includes tumbling barrels, parts washing machines, pickling machines, tanks, shot and abrasive blast types, plus all other similar equipment not elsewhere listed

91,541 units—36% are at least 10 years old; 13% over 20 years old

	TOTAL CLEANING EQUIPMENT			TUMBLING BARRELS			SHOT AND ABRASIVE BLAST			PARTS WASHING MACHINES			PICKLING MACHINES			TANKS		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	1,698	456	243	460	190	135	294	90	21	709	159	87	24	7	–	211	10	–
Construction, Mining, Oil Well	1,078	257	64	220	110	40	300	87	30	144	23	7	23	–	–	391	37	7
Metalworking Machinery	2,034	291	282	577	100	113	633	110	88	359	33	28	43	8	3	422	40	50
Special-Industry Machinery	4,036	1,391	728	2,418	900	502	541	144	121	304	66	22	44	11	11	729	270	72
General Industrial Equipment	3,050	525	826	1,211	125	701	562	121	59	492	70	7	40	–	–	745	209	59
Office and Store Machines	2,156	451	663	1,363	350	590	85	12	16	289	81	49	8	–	–	411	8	8
Domestic and Service Equip.	3,568	705	331	859	187	219	354	81	24	865	134	70	199	43	3	1,291	260	15
Electrical Equipment	7,069	1,489	556	2,045	376	320	961	132	133	1,265	245	57	96	17	2	2,702	719	50
Misc. Machine Parts, Jobbing	5,331	1,328	550	3,215	870	440	431	64	18	1,090	284	55	82	–	–	513	110	37
Motor Vehicles and Parts	7,015	1,995	872	1,324	376	314	630	172	21	2,278	641	169	435	135	21	2,338	671	347
Aircraft and Parts	2,084	177	4	236	5	–	388	31	4	496	22	–	33	–	–	931	119	–
Railroad Equipment	448	40	101	141	15	73	115	10	23	116	10	3	18	5	–	58	–	2
Fabricated Metal Products	32,916	9,246	4,636	17,903	5,948	3,973	2,288	656	227	3,394	487	116	487	121	6	8,844	2,034	312
Shipbuilding, Ordnance, Misc.	12,774	2,324	1,034	3,601	1,069	606	4,874	314	210	2,207	578	21	127	3	6	1,96.	360	191
Precision Mechanisms	6,284	1,267	636	3,003	698	604	479	203	4	1,235	132	–	118	10	17	1,449	224	11
Total	91,541	21,942	11,546	38,586	11,319	8,630	12,935	2,227	999	15,243	2,965	687	1,777	360	69	23,000	5,071	1,161
BY GEOGRAPHIC AREA																		
Boston	7,580	1,792	1,283	3,470	992	986	1,174	282	102	929	153	27	27	–	7	1,980	365	161
Bridgeport – Hartford	8,258	2,297	2,217	5,091	1,564	2,035	647	81	70	787	67	8	81	31	8	1,652	554	96
New England	3,141	898	407	2,134	805	348	382	44	39	209	15	5	15	–	–	401	34	15
New York – Newark	9,902	3,333	401	6,188	2,589	337	607	79	16	1,157	224	32	53	21	–	1,897	410	16
Buffalo – Rochester	2,381	563	347	965	200	310	154	37	10	571	234	13	137	42	7	554	50	7
Philadelphia	5,138	1,130	482	2,870	664	410	855	64	28	576	95	28	93	32	–	744	275	16
Pittsburgh – Wheeling	1,221	252	132	322	128	66	234	40	26	300	49	13	31	9	8	334	26	18
Middle Atlantic	6,793	1,247	1,514	3,193	502	1,188	1,264	174	246	723	118	31	144	3	7	1,469	450	42
Baltimore	180	33	18	27	–	3	50	9	3	38	3	–	–	–	–	65	21	12
Southern	6,633	1,517	358	1,512	364	274	1,331	261	11	2,389	661	6	53	–	–	1,348	231	67
Cleveland – Youngstown	3,639	501	499	1,359	314	312	739	49	94	680	73	73	142	12	–	729	53	20
Cincinnati – Youngstown	1,168	210	176	488	101	109	138	16	8	359	66	50	85	21	6	98	6	3
Detroit – Toledo	6,089	1,436	810	1,356	437	302	603	136	19	1,661	264	158	224	59	8	2,245	540	323
Milwaukee	1,097	208	134	236	42	21	334	81	35	137	32	11	49	4	4	341	49	63
Chicago	6,311	1,695	545	2,792	647	425	901	167	32	984	226	19	136	50	–	1,498	605	69
Indianapolis	355	80	5	94	11	2	72	9	–	150	51	3	33	9	–	6	–	–
Midwestern	13,304	3,161	1,566	4,367	1,526	1,054	2,228	368	204	1,757	210	111	162	36	4	4,790	1,021	193
Minneapolis – St. Paul	668	130	2	217	14	2	38	9	–	123	9	–	9	–	–	281	98	–
St. Louis – Kansas City	1,815	464	321	691	131	267	157	69	–	551	197	4	164	27	10	252	40	40
Central and Mountain	1,812	414	189	448	104	67	338	78	33	566	146	89	44	4	–	416	82	–
Houston	203	66	20	22	8	–	79	33	14	80	25	6	–	–	–	22	–	–
Southwestern	1,278	169	97	230	48	97	232	73	–	172	12	–	12	–	–	632	36	–
San Francisco – Oakland	406	110	6	155	26	6	71	26	–	77	6	–	6	–	–	97	52	–
Los Angeles	1,348	157	6	244	35	3	170	29	3	186	29	–	42	–	–	706	64	–
Pacific	821	79	12	115	57	6	147	13	6	81	–	–	35	–	–	443	9	–
Total	91,541	21,942	11,546	38,586	11,319	8,630	12,935	2,227	999	15,243	2,965	687	1,777	360	69	23,000	5,071	1,161

ELECTRIC WELDING

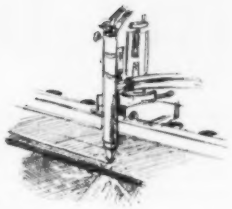


(Standard Commodity Code: 3450 00) Includes motor generator type arc welding (3451 12); transformer powered arc (3451 11); automatic and other types (3451 18); resistance welding equipment (3451 20) such as spot, projection, and gun (3451 23), seam (3451 22), plus butt and flash types (3451 21)

165,101 units—30% are at least 10 years old; 6% over 20 years old

	TOTAL ELECTRIC			ARC: MOTOR GENERATOR SET			ARC: TRANSFORMER			ARC: AUTOMATIC AND OTHER			RESISTANCE: SPOT			RESISTANCE: PROJECTION		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	4,902	867	131	2,377	464	52	1,619	152	3	114	3	–	547	197	55	76	10	–
Construction, Mining, Oil Well	8,928	2,157	334	5,588	1,676	287	2,536	287	–	476	94	7	234	70	53	10	–	–
Metalworking Machinery	3,226	603	126	1,669	197	50	756	53	5	166	15	–	397	110	23	8	–	–
Special-Industry Machinery	6,150	1,243	332	4,146	751	144	673	132	17	171	28	11	867	276	121	50	–	–
General Industrial Equip.	7,822	1,681	568	4,711	1,193	195	1,505	196	11	191	15	4	778	198	73	106	7	26
Office and Store Machines	1,342	391	167	260	114	4	20	–	–	4	–	–	708	167	159	216	102	4
Domestic and Service Equip.	6,994	2,016	519	786	427	115	584	67	141	555	104	10	2,790	785	208	1,012	227	10
Electrical Equipment	21,146	5,369	533	3,188	694	195	2,697	501	76	484	29	7	12,961	3,718	211	792	189	5
Misc. Machine Parts, Jobbing	4,212	823	82	2,024	522	46	1,218	126	9	284	18	–	566	126	18	18	–	–
Motor Vehicles and Parts	18,012	5,341	1,975	5,100	1,432	333	1,229	362	8	1,429	362	93	5,944	2,254	1,193	3,469	591	166
Aircraft and Parts	2,296	186	2	1,184	113	–	185	11	–	110	2	–	584	31	–	16	13	–
Railroad Equipment	4,965	483	153	2,842	282	46	1,272	53	3	166	10	–	385	98	48	60	8	–
Fabricated Metal Products	48,959	11,597	2,596	19,030	4,614	501	6,192	538	67	2,631	770	192	15,469	4,169	1,498	1,238	300	12
Shipbuilding, Ordnance, Misc.	23,120	6,817	853	17,497	5,683	786	3,026	369	13	717	205	14	988	401	30	65	29	–
Precision Mechanisms	3,027	858	306	616	67	–	493	290	–	29	21	–	1,741	428	289	50	34	–
Total	165,101	40,411	8,737	70,640	18,389	2,754	24,009	3,141	353	7,531	1,676	338	44,961	13,030	3,979	5,226	1,501	223
BY GEOGRAPHIC AREA																		
Boston	10,871	3,073	495	2,575	459	169	943	336	16	186	55	16	6,700	2,117	251	71	12	–
Bridgeport – Hartford	2,659	634	189	801	160	101	143	8	6	112	11	17	1,036	311	37	275	48	3
New England	2,531	609	190	734	165	49	437	101	5	73	24	19	932	217	73	122	34	–
New York – Newark	8,475	2,050	263	3,605	968	84	1,214	150	11	258	37	5	3,093	836	158	42	11	–
Buffalo – Rochester	3,625	987	347	1,062	217	17	564	140	–	358	107	–	991	351	147	190	43	3
Philadelphia	8,540	3,161	421	4,582	2,235	230	1,334	159	6	361	107	8	1,580	466	64	167	71	–
Pittsburgh – Wheeling	6,696	1,961	455	3,554	1,373	225	1,652	437	119	239	35	–	891	259	93	57	13	–
Middle Atlantic	11,507	2,084	575	4,610	918	205	1,666	103	3	208	21	–	3,600	786	264	652	49	7
Baltimore	534	183	15	231	112	–	24	3	3	12	–	–	234	68	9	–	–	–
Southern	12,189	4,087	431	6,628	2,493	267	1,850	333	17	698	552	–	1,782	440	62	349	90	6
Cleveland – Youngstown	7,214	1,928	582	2,339	606	106	989	45	12	502	57	119	2,462	851	240	269	118	24
Cincinnati – Dayton	2,931	661	225	1,050	182	53	198	14	2	248	32	42	865	227	111	341	127	3
Detroit – Toledo	12,192	2,931	1,600	3,007	767	263	839	224	8	1,106	265	82	3,866	1,214	916	933	215	152
Milwaukee	4,717	1,014	142	2,245	658	102	1,380	81	–	116	14	4	556	112	14	113	46	4
Chicago	16,610	3,625	346	8,077	1,710	90	2,440	228	6	740	51	–	3,894	1,310	257	424	139	–
Indianapolis	774	217	19	239	81	5	55	8	–	76	11	–	332	89	12	50	14	–
Minnesota	26,896	6,335	1,851	16,170	2,247	412	4,405	373	315	1,063	325	11	7,705	2,265	902	875	432	21
Minneapolis – St. Paul	1,212	140	21	375	70	11	126	20	–	14	–	–	272	39	5	14	–	–
St. Louis – Kansas City	2,106	781	242	1,111	197	43	704	35	22	230	62	7	958	392	179	117	26	–
Central and Mountain	4,918	1,111	261	2,366	151	116	658	70	–	69	11	–	957	223	89	93	7	–
Rosedale	377	219	5	200	105	4	147	89	–	3	–	–	19	8	3	–	–	–
Southwestern	6,789	1,294	146	4,179	1,169	31	1,344	48	–	275	–	–	805	121	61	1	–	–
San Francisco – Oakland	2,908	455	37	1,166	193	12	535	58	–	161	19	6	213	135	19	26	6	–
Los Angeles	1,455	633	56	1,117	384	4	453	16	–	337	77	–	738	176	13	22	–	–
Pacific	2,190	471	3	2,277	393	3	246	32	–	96	3	–	460	55	–	3	–	–
Total	165,101	40,411	8,737	70,640	18,389	2,754	24,009	3,141	353	7,531	1,676	338	44,961	13,030	3,979	5,226	1,501	223

GAS WELDING



(Standard Commodity Code: 3452 40 and 90) Includes flame cutting machines and gas welding equipment of all types. This total is not included with electric welding group.

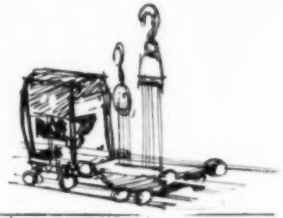
15,747 units—23% at least 10 years old; 2% over 20 years old

RESISTANCE GUN			RESISTANCE SEAM			RESISTANCE BUTT & FLASH				TOTAL GAS			FLAME CUTTING			GAS WELDING		
TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR		TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
									BY INDUSTRY									
59	14	–	55	10	7	55	17	14	Agricultural Machinery	340	79	3	215	31	3	125	48	–
17	–	–	20	17	–	43	13	7	Constr, Mining, Oil Well	982	207	20	818	180	20	164	27	–
38	–	–	15	3	–	173	25	48	Metalworking Machinery	1,004	153	8	582	113	5	422	40	3
66	6	–	28	–	6	149	50	33	Special-Industry Machinery	1,181	226	39	811	171	33	370	55	6
59	18	–	15	4	–	437	48	279	General Industrial Equipment	1,042	195	15	745	136	11	297	59	4
53	–	–	28	–	–	33	8	–	Office and Store Machines	52	8	–	24	4	–	28	4	–
978	232	3	392	122	17	277	52	15	Domestic, Service Equipment	209	52	10	109	32	10	100	20	–
118	13	–	209	44	7	697	160	52	Electrical Equipment	909	193	48	652	139	36	257	54	12
9	–	–	9	–	–	82	27	9	Misc. Machine Parts, Jobbing	1,145	247	–	788	192	–	357	55	–
512	37	1	178	51	32	2,151	272	149	Motor Vehicles and Parts	218	52	6	182	38	6	36	14	–
42	–	–	73	–	–	102	16	2	Aircraft and Parts	141	9	–	77	9	–	64	–	–
55	7	–	125	20	43	60	25	13	Railroad Equipment	202	28	19	174	28	17	28	–	2
1,420	180	51	978	253	25	2,001	773	250	Fabricated Metal Products	5,242	1,179	83	3,464	733	26	1,778	446	57
415	36	–	205	33	–	207	70	10	Ships, Ordnance, Misc	2,626	469	14	2,260	385	14	366	84	–
17	–	–	17	–	–	62	18	17	Precision Mechanisms	454	143	6	171	21	–	283	122	6
3,858	543	55	2,347	557	137	6,529	1,574	898	Totals	15,747	3,240	271	11,072	2,212	181	4,675	1,028	90
									BY GEOGRAPHIC AREA									
35	4	–	141	35	–	220	55	43	Boston	793	118	31	512	102	15	281	16	16
53	6	–	90	45	–	149	45	25	Bridgeport – Hartford	284	45	3	160	31	3	124	14	–
24	10	–	78	24	10	131	34	34	New England	335	151	10	238	107	10	97	44	–
116	16	–	26	–	–	121	32	5	New York – Newark	980	173	16	637	110	16	343	63	–
20	–	20	73	–	10	367	129	150	Buffalo – Rochester	197	36	3	160	33	3	37	3	–
151	–	–	83	12	–	282	91	111	Philadelphia	1,109	203	32	954	159	24	155	44	8
101	9	–	109	22	–	93	13	18	Pittsburgh – Wheeling	556	212	4	503	194	4	53	18	–
159	7	–	245	49	44	367	111	52	Middle Atlantic	846	152	36	682	135	29	164	17	7
12	–	–	12	–	–	9	–	3	Baltimore	86	21	–	56	12	–	30	9	–
364	22	–	241	28	25	289	129	34	Southern	1,458	375	17	1,099	306	11	359	69	6
37	8	–	77	49	–	519	194	81	Cleveland – Youngstown	927	319	38	448	81	14	479	238	24
18	–	–	76	14	–	135	45	14	Cincinnati – Dayton	111	10	–	93	10	–	18	–	–
467	42	26	129	40	30	1,845	154	123	Detroit – Toledo	193	31	6	146	21	6	47	10	–
137	11	–	56	46	–	113	46	18	Milwaukee	401	53	4	345	49	4	56	4	–
572	59	–	169	64	13	338	64	–	Chicago	1,036	274	–	692	167	–	344	107	–
2	–	–	8	–	–	31	8	2	Indianapolis	37	5	–	28	5	–	9	–	–
1,133	299	9	448	74	–	1,096	320	139	Midwestern	2,820	511	45	1,780	277	20	1,040	234	25
161	–	–	14	2	5	36	9	–	Minneapolis – St. Paul	118	16	–	57	7	–	61	9	–
32	7	–	37	15	–	51	7	–	St. Louis – Kansas City	292	92	–	208	77	–	84	15	–
97	22	–	66	19	–	98	26	19	Central and Mountain	496	108	26	366	63	22	130	45	4
–	–	–	–	–	–	14	6	5	Houston	73	39	–	58	28	–	15	11	–
75	12	–	37	–	–	72	24	24	Southwestern	1,637	133	–	1,327	97	–	310	36	–
6	6	–	39	19	–	39	19	–	San Francisco – Oakland	329	77	–	265	64	–	64	13	–
58	3	–	55	–	–	71	13	–	Los Angeles	337	28	–	247	22	–	90	6	–
29	–	–	38	–	–	44	–	–	Pacific	316	58	–	231	55	–	85	3	–
3,858	543	55	2,347	557	137	6,529	1,574	898	Total	15,747	3,240	271	11,072	2,212	181	4,675	1,028	90

CRANE, HOISTS, AIR COMPRESSORS

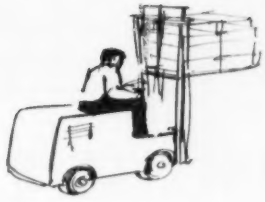
Includes overhead traveling cranes (Std. Commodity Code: 3152 00) with a separate total of 48,279 units of which 53% are at least 10 years old; 40% over 20 years old. Also a group including hoists such as hand chain (3158 13), electric (3158 12), and pneumatic (3158 11) which total 270,230 units with 35% at least 10 years old; 11% over 20 years old Hoist figures include all jib (3150 00) and rail mounting (3146 30) type units

Air compressors (3121 00), listed separately, total 39,797 of which 28% are at least 10 years old; 12% over 20 years old



	CRANES OVERHEAD TRAVELING (NOT IN TOTAL)			TOTAL HOISTS			HOISTS CHAIN, HAND			HOISTS ELECTRIC			HOISTS PNEUMATIC			AIR COMPRESSORS (NOT IN TOTAL)		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY																		
Agricultural Machinery	1,180	543	353	19,465	5,452	2,176	4,332	1,626	1,335	7,933	1,522	208	7,200	2,304	633	737	180	104
Construction, Mining, Oil Well	2,679	534	658	12,853	3,270	1,587	4,843	1,657	1,156	6,981	1,206	284	1,029	407	147	969	204	234
Metalworking Machinery	4,907	1,024	1,707	20,711	5,462	2,724	11,431	3,574	2,023	8,788	1,790	648	492	98	53	1,805	399	208
Special-Industry Machinery	2,655	607	889	14,755	3,594	2,445	7,248	2,578	1,507	6,867	867	618	640	149	320	2,445	640	530
General Industrial Equipment	3,031	822	811	18,863	5,116	1,336	8,580	3,064	947	7,751	1,501	209	2,532	551	180	1,919	382	235
Office and Store Machines	57	–	4	887	195	69	460	167	69	423	28	–	4	–	–	220	69	16
Domestic and Service Equip.	690	170	178	6,552	1,797	414	2,992	960	136	3,010	678	260	542	159	18	780	214	73
Electrical Equipment	4,708	355	2,464	17,421	3,623	2,659	5,908	1,880	549	10,939	1,625	2,070	574	118	40	3,878	882	243
Misc. Machine Parts, Jobbing	1,162	357	165	12,448	3,142	981	6,641	2,116	834	5,560	916	101	247	110	46	1,969	522	202
Motor Vehicles and Parts	3,196	681	1,243	19,735	3,406	1,978	5,950	1,096	422	12,772	2,003	1,303	1,013	307	253	744	206	124
Aircraft and Parts	830	12	–	5,717	293	–	2,943	156	–	2,546	93	–	228	44	–	476	99	5
Railroad Equipment	1,365	128	1,088	4,609	963	1,526	628	67	471	3,754	811	1,024	227	85	31	274	53	106
Fabricated Metal Products	8,201	1,982	2,499	48,634	12,940	4,136	20,916	7,727	1,710	25,190	4,305	2,186	2,528	908	240	13,864	3,221	1,759
Shipbuilding, Ordnance, Misc.	13,361	1,828	7,262	62,807	13,401	8,289	40,555	9,881	4,090	17,964	2,565	3,326	4,288	955	873	7,316	1,013	1,246
Precision Mechanisms	256	11	39	4,773	1,153	282	2,831	1,148	248	1,900	5	34	42	–	–	2,401	635	101
Total	48,279	8,854	19,360	270,230	63,807	30,602	126,258	37,697	15,497	122,386	19,915	12,271	21,586	6,195	2,834	39,797	8,719	5,186
BY GEOGRAPHIC AREA																		
Boston	3,422	447	1,737	14,638	3,950	1,888	8,284	2,887	1,028	5,584	902	699	770	161	161	2,378	531	288
Bridgeport-Hartford	1,501	129	393	10,397	2,340	1,472	6,285	1,897	1,042	3,621	385	388	491	58	42	1,343	227	243
New England	1,915	430	988	8,358	2,359	1,516	4,946	1,853	906	3,197	496	497	215	10	113	1,696	620	314
New York-Newark	3,758	1,352	552	20,183	6,008	1,448	10,418	3,888	773	8,672	1,788	537	1,093	332	138	3,258	815	316
Buffalo-Rochester	1,359	444	310	4,216	1,082	256	1,806	649	241	2,253	394	15	157	39	–	644	97	40
Philadelphia	3,238	748	1,570	16,046	4,339	2,238	11,030	3,586	1,554	4,457	585	645	559	168	39	1,715	250	230
Pittsburgh-Wheeling	2,368	410	1,120	3,965	970	489	1,288	459	207	2,448	454	282	229	57	–	1,356	287	339
Middle Atlantic	3,135	489	4,049	21,175	3,024	4,622	5,625	1,490	956	13,603	1,072	3,402	1,947	462	264	2,517	503	516
Baltimore	212	11	67	1,271	159	32	964	113	21	307	46	11	–	–	–	519	62	27
Southern	2,079	354	793	17,047	5,474	1,285	8,662	3,013	352	7,857	2,331	896	528	130	37	2,746	667	289
Cleveland-Youngstown	2,962	517	807	15,699	2,176	1,255	7,605	1,649	470	7,644	398	651	450	129	134	1,903	389	187
Cincinnati-Dayton	1,557	204	567	7,768	2,767	756	3,629	1,459	469	3,931	1,240	234	208	68	53	206	45	19
Detroit-Toledo	2,025	326	857	9,772	1,294	810	2,565	605	38	6,559	599	569	648	90	203	1,071	196	97
Milwaukee	2,307	275	1,320	6,264	1,807	355	1,978	774	170	3,543	758	170	743	275	15	803	137	77
Chicago	2,212	437	675	11,925	3,442	1,591	6,801	1,936	880	4,633	1,297	698	491	209	13	3,032	811	486
Indianapolis	58	–	25	2,576	723	34	1,504	490	17	1,055	233	17	17	–	–	64	11	9
Midwestern	6,555	1,175	2,478	59,605	11,656	7,055	24,836	5,115	4,096	24,972	3,628	1,693	9,797	2,913	1,266	7,812	1,935	918
Minneapolis-St. Paul	163	16	66	1,830	322	18	434	145	–	1,127	166	18	269	11	–	272	59	9
St. Louis-Kansas City	672	145	242	5,995	1,746	1,176	2,384	817	836	3,048	743	210	563	186	130	541	110	84
Central and Mountain	909	224	89	9,718	2,583	721	4,174	1,161	512	4,332	1,014	163	1,212	408	96	1,304	241	141
Houston	335	105	14	2,250	770	41	973	399	–	1,115	297	34	162	74	7	129	30	25
Southwestern	1,512	242	327	8,234	1,960	242	4,324	1,500	157	3,675	399	85	235	61	–	1,977	315	306
San Francisco-Oakland	648	191	172	3,364	1,639	486	1,782	1,077	191	1,334	410	257	248	152	38	528	90	135
Los Angeles	880	148	87	5,078	762	713	2,523	376	546	2,125	225	100	430	161	67	1,218	202	35
Pacific	497	35	55	2,856	455	53	1,438	359	35	1,294	55	–	124	41	18	965	89	56
Total	48,279	8,854	19,360	270,230	63,807	30,602	126,258	37,697	15,497	122,386	19,915	12,271	21,586	6,195	2,834	39,797	8,719	5,186

INDUSTRIAL TRUCKS



(Standard Commodity Code: 3161 00) Includes lift (3161 11); truck-tractors (3163 00); powered hand trucks (3161 25); also crane trucks (3161 13). Gasoline and electric power are consolidated

95,199 machines—23% are at least 10 years old; 5% over 20 years old

	TOTAL TRUCKS			LIFT			TRUCK-TRACTOR			POWERED HAND TRUCKS			CRANE TRUCKS		
	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR	TOTAL	10-20 YEARS	OVER 20 YR
BY INDUSTRY															
Agricultural Machinery	5,076	782	294	2,983	557	183	830	125	104	986	69	–	277	31	7
Construction, Mining, Oil Well	2,193	374	80	1,122	147	53	407	77	7	190	–	3	474	150	17
Metalworking Machinery	6,212	933	763	2,533	419	153	339	35	18	592	45	45	2,748	434	547
Special-Industry Machinery	4,074	862	287	2,832	701	237	403	39	28	646	61	–	193	61	22
General Industrial Equip	4,999	661	113	3,325	525	48	525	37	29	899	73	7	250	26	29
Office and Store Machines	766	110	216	602	98	212	37	8	4	94	–	–	33	4	–
Domestic and Service Equip.	4,976	1,382	184	3,299	1,060	130	654	139	48	890	151	6	133	32	–
Electrical Equipment	9,482	898	481	6,211	715	409	1,554	110	57	1,494	45	5	223	28	10
Misc. Machine Parts, Jobbing	3,261	577	540	2,024	357	531	284	55	–	577	55	9	376	110	–
Motor Vehicles and Parts	7,792	1,450	315	4,664	1,159	65	1,455	221	167	1,490	46	73	183	24	8
Aircraft and Parts	1,940	76	–	1,100	50	–	286	12	–	471	–	–	83	6	–
Railroad Equipment	777	128	50	528	107	29	123	12	5	76	2	–	50	7	16
Fabricated Metal Products	23,432	5,236	949	17,226	4,379	722	2,414	391	173	2,823	276	–	969	190	54
Shipbuilding, Ordnance, Misc.	17,982	4,037	520	7,646	792	297	2,514	329	142	5,847	2,414	6	1,975	502	75
Precision Mechanisms	2,237	266	17	1,900	245	17	245	20	–	39	–	–	53	1	–
Total	95,199	17,772	4,807	57,995	11,319	3,086	12,070	1,610	782	17,114	3,237	154	8,020	1,606	785
BY GEOGRAPHIC AREA															
Boston	4,320	713	247	3,303	661	208	376	24	12	492	4	27	149	24	–
Bridgeport – Hartford	2,340	370	136	1,661	322	93	211	45	34	401	–	3	67	3	6
New England	2,746	525	354	1,976	392	241	297	41	82	396	82	–	77	10	31
New York – Newark	4,865	1,080	359	3,566	808	347	536	62	6	549	167	6	214	43	–
Buffalo – Rochester	1,441	405	14	1,193	353	14	124	33	–	81	–	–	43	19	–
Philadelphia	4,450	689	241	2,955	504	133	697	86	82	445	17	9	353	82	17
Pittsburgh – Wheeling	1,923	378	357	1,526	347	344	181	9	–	123	4	–	93	18	13
Middle Atlantic	6,640	1,193	239	4,127	655	156	1,206	104	45	856	309	–	451	125	38
Baltimore	318	44	–	162	40	–	74	4	–	64	–	–	18	–	–
Southern	8,886	2,085	267	3,077	617	39	954	292	–	2,484	609	–	2,371	567	228
Cleveland – Youngstown	5,035	1,069	211	3,499	929	98	465	88	62	688	5	10	383	47	41
Cincinnati – Dayton	1,898	280	304	1,467	212	280	121	8	8	200	49	8	110	11	8
Detroit – Toledo	3,632	379	276	2,232	286	181	675	70	47	612	5	43	113	18	5
Milwaukee	2,269	241	133	1,502	151	101	372	39	12	302	39	20	93	12	–
Chicago	7,851	1,535	283	4,372	862	148	534	122	26	2,443	397	6	502	154	103
Indianapolis	3,001	1,101	–	1,064	266	–	75	33	–	1,521	652	–	341	150	–
Midwestern	19,392	2,887	963	12,028	2,264	445	3,005	290	246	2,805	255	22	1,554	78	250
Minneapolis – St. Paul	1,441	341	73	1,131	325	73	41	7	–	232	2	–	37	7	–
St. Louis – Kansas City	2,117	379	102	1,244	304	97	249	54	5	458	–	–	166	21	–
Central and Mountain	4,693	1,418	215	2,487	694	85	886	111	115	997	479	–	323	134	15
Houston	592	163	3	194	37	–	118	17	–	230	95	–	50	14	–
Southwestern	1,564	145	–	902	85	–	355	36	–	109	–	–	198	24	–
San Francisco – Oakland	800	163	29	410	86	–	95	–	–	200	67	–	95	10	29
Los Angeles	1,794	144	–	1,078	96	–	244	32	–	379	–	–	93	16	–
Pacific	1,191	45	4	839	23	3	179	3	–	47	–	–	126	19	1
Total	95,199	17,772	4,807	57,995	11,319	3,086	12,070	1,610	782	17,114	3,237	154	8,020	1,606	785

3 OUT OF 4 COLLEGE MACHINES ARE MODERN

Only 25.7% of university shop equipment is more than ten years old. Three-quarters of an average of 100 units per shop are machine tools, mostly lathes, drillpresses, grinders and horizontal millers. Broadening of training facilities is indicated by low percentage of over-age units other than machine tools

FOR THE first time in our quarter century of inventorying equipment of the metalworking industry, we include here a study of college metalworking shops. In contrast to the prevailing opinion that such shops are antiquated and poorly equipped, our recent articles dealing with shop training (*A.M.*, April 7, 1949, and thereafter) indicated extensive modernization. To determine the extent of this modernization, because such plants represent major investments in metalworking equipment, and because no study of them has ever been made to our knowledge, we have this year added such shops to our inventory.

Returns were received from 40 of the total of slightly over a hundred colleges giving courses in mechanical or industrial engineering. Some of the remainder have neither shop courses nor shops. The colleges here represented, however, are a good cross-section, ranging from the largest to the smallest. There is no adequate base for expanding the figures received, so these are presented simply as a summary of the equipment in 40 colleges, and probably including most of the colleges with the best present-day shops. In practically all cases, only units in instructional shops are included; several larger colleges indicate they have again as many devoted to specialized research projects or for normal maintenance operations. Undoubtedly in smaller colleges the instructional equipment does double duty. Based on this study, the indications are that colleges have 7,500 to 10,000 machine tools and 2500 to 3000 other units.

The 40 colleges represented have a total of 3,932 units of metalworking equipment, or approximately 100 units per shop. Approximately three-fourths of this is machine tools and only about 5% metal-forming machinery.

As would be expected, most of the equipment is what might be called basic, or general, machine tools, such as lathes, grinders, drillpresses, saws, and horizontal millers. Further, there are as many engine lathes as there are grinding machines of all types, and roughly half of the grinding machines are represented by bench, floor-stand and tool-grinding types. It is fairly obvious that production machines are usually installed on a one-of-a-kind basis to provide typical examples rather than usable instruction machines, and further, that such machines are found only in the larger shops. There is relatively little metal-forming equipment, and most of that again is of the basic types, the emphasis, as would be expected, being on simpler types of forming equipment. One southwestern college has about a third of all the metal-forming units reported, indicating emphasis on forming there, probably with aircraft-plant needs in mind.

In the category of "Other Shop Equipment," the major emphasis is on electric welding, on heating furnaces (particularly heat-treating), and on chain hoists.

Little Obsolete Equipment

The aggressiveness of the colleges in obtaining war surplus material is reflected in surprisingly low percentages of obsolete equipment. Approximately three-fourths of all units, regardless of category, are under ten years old. The overall figure is 74.3%. Recent greater emphasis on metal forming is reflected in the fact that the highest percentage of new equipment is in metal-forming machinery, where 76.7% is under ten years old. The poorest record is made in the group of "Other Shop Equipment," where only 72.5% is under ten years old. However, 22½% is between 10 and 20 years old, indicating the cooper-

COLLEGE SHOPS ARE FAR MORE UP-TO-DATE THAN THOSE IN INDUSTRY

	Under 10 Years		10-20 Years		Over 20 Years	
	Number	Percent	Number	Percent	Number	Percent
All Equipment	2922	74.3	518	13.2	492	12.5
Machine Tools	2167	74.6	306	10.5	430	14.9
Metal-Forming Machinery	165	76.7	29	13.5	21	9.8
Other Shop Equipment	590	72.5	183	22.5	41	5.0
SOME TYPICAL LARGE GROUPS:						
Lathes	674	70.2	107	11.1	179	18.7
Drills	276	77.3	38	10.6	43	12.1
Grinders	450	80.2	59	10.5	52	9.3
Millers	234	73.4	31	9.7	54	16.9
Punches & Shears	53	85.5	6	9.7	3	4.8
Electric Welders	192	82.1	36	15.4	6	2.5
Hoists	88	71.5	30	24.4	5	4.1
Furnaces	133	62.4	62	29.1	8	8.5

BASIC MACHINE TOOLS ARE HALF OF ALL COLLEGE SHOP EQUIPMENT

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	2,903	306	430
Boring Machines	45	–	10
Horizontal boring, drilling, and milling	8	–	3
Vertical boring mills including vertical turret lathes	17	–	7
Precision, horizontal and vertical	2	–	–
Jig boring, horizontal and vertical	11	–	–
Other	2	–	–
Broaching Machines	33	2	–
Horizontal internal	4	–	–
Horizontal surface	–	–	–
Vertical internal	1	–	–
Vertical surface	6	–	–
Other	2	–	–
Contour sawing and filing	20	2	–
Cutoff Machines	133	18	10
Bandsaw	39	4	–
Abrasive disk	20	–	–
Hacksaws	61	14	10
Rotary, hot or cold	2	–	–
Other	1	–	–
Drilling Machines	357	38	43
Sensitive	142	11	10
Upright: Single-spindle	129	16	24
Gang	31	3	2
Radial	38	4	6
Multi-spindle cluster, adjustable & fixed center	1	–	–
Unit head and way type, multi-spindle	3	–	–
Deep-hole drills	–	–	–
Other	13	4	1
Gear Cutting and Finishing Machines	90	2	5
Hobbing machines	34	1	4
Shapers, gear	33	1	1
Cutters, form-milling type	4	–	–
Bevel gear cutters (not planer)	6	–	–
Cutters, planer type	2	–	–
Grinders, gear	1	–	–
Shavers, gear	4	–	–
Burnishing and lapping	2	–	–
Chamfering, tooth pointing, tooth rounding	2	–	–
Other	2	–	–
Gear Checking Machines	20	–	–
Grinding Machines	561	59	52
External cylindrical, plain and universal	76	6	14
Internal cylindrical	29	3	–
Centerless: External	11	–	–
Internal	1	–	–
Surface: Rotary table type	26	1	–
Reciprocating type	55	6	5
Disk, horizontal and vertical	20	2	–
Tool and cutter	78	11	8
Bench, floor stand, and snag	221	24	22
Abrasive belt (not polishing)	23	4	–
Other	21	2	3
Honing and Lapping	33	3	–
Honing	20	2	–
Lapping: External	4	1	–
Internal	–	–	–
Surface	9	–	–
Lathes	960	107	179
Bench and floor, light-duty	245	25	44
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	569	56	124
Turret lathes: Ram type and hand screw	77	8	8
Saddle type	18	3	–
Automatic chucking, horizontal and vertical	1	1	–
Automatic between centers chucking	13	1	–
Automatic screw machines, bar	26	7	3
Gun and shaft boring	–	–	–
Other	11	6	–
Milling Machines	319	31	54
Bench type	15	1	–
Hand	14	4	1
Knee-type, horizontal	163	15	49
Vertical	57	4	3
Automatic and manufacturing	47	6	–
Bed (Lincoln) type, incl automatic rise and fall	6	1	–
Planer type	3	–	1
Die sinkers (except engraving) & duplicators	9	–	–
Other	5	–	–
Planers	33	2	27
Double housing	26	1	25
Openside	6	1	1
Other	1	–	1
Pipe Cutting and Threading Machines	10	4	–
Polishing and Buffing Machines	116	19	8
Speed lathes	39	7	6
Polishing stands	34	4	2
Abrasive belt	31	3	–
Other	12	5	–
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	122	21	37
Horizontal	107	20	34
Vertical, including slotters	13	–	3
Keyseaters	2	1	–
Threading (except pipe)	49	–	5
Tapping	17	–	1
Hobbing and milling	15	–	4
Die type	1	–	–
Grinders, thread	11	–	–
Rolling machines, thread	5	–	–
Other	–	–	–
Other Machine Tools	22	–	–
METAL FORMING MACHINERY	215	29	21
Bending and Forming Machines	53	–	8
Bending rolls, sheet and plate	16	–	–
Bending rolls, bars and shapes	1	–	–
Power bending brakes	4	–	–
Rotary forming machines	18	–	6
Bending machines, pipe and bar	7	–	2
Other	7	–	–
Hydraulic Presses	32	7	–
Vertical, single action	30	6	–
Vertical, double and triple action	2	1	–
Horizontal	–	–	–
Other (including hydro-pneumatic)	–	–	–
Pneumatic Presses (except hydro-pneumatic)	–	–	–
Mechanical Presses, Power Driven	41	9	2
Inclinable	25	6	2
Vertical, C-frame	8	2	–
Vertical, straight-sided	6	1	–
Dieing machines	–	–	–
Horizontal	–	–	–
Other	2	–	–
Punching and Shearing Machines	62	6	3
Punching machines	17	2	1
Plate and sheet shears	25	3	1
Bar and angle shears	5	1	1
Rotary shears	7	–	–
Other	8	–	–
Forging Machinery (except presses)	12	–	5
Hammers, steam or air	4	–	2
Hammers, gravity drop	2	–	1
Hammers, helve	3	–	2
Forging machines (headers) and rolls	–	–	–
Other	3	–	–
Swaging Machines	4	–	2
Bite and Strip Forming Machines	–	–	–
Die Casting Machines	2	1	–
Hot chamber	1	–	–
Cold chamber	1	1	–
Plastic Molding Machines	6	5	–
Injection	1	1	–
Compression	5	4	–
Riveting Machines (Not Portable)	3	1	1
OTHER SHOP EQUIPMENT	814	183	41
Electric Welding Machines (Not Hand)	234	36	6
Arc: Motor-generator set	130	28	5
Transformer	35	2	–
Automatic and other	19	1	–
Resistance: Spot	39	5	1
Projection	2	–	–
Gun	1	–	–
Seam	3	–	–
Butt and flash	5	–	–
Gas Welding, Cutting Machines (Not Hand)	67	9	6
Flame cutting	38	9	–
Welding	29	–	6
Balancing Machines	9	–	–
Air Compressors	66	16	3
Plating Equipment	23	21	–
Machines	2	1	–
Tanks	21	20	–
Barrels	–	–	–
Materials Heating Equipment	213	62	8
Heat-treating furnaces	101	26	5
Stock-heating furnaces	33	14	–
Salt baths	35	19	2
Induction heating units	23	1	–
Baking and drying ovens	21	2	1
Flame hardening	–	–	–
Cleaning Equipment	29	5	6
Tumbling barrels	10	1	5
Shot and abrasive blast	15	4	1
Parts washing machines	–	–	–
Pickling machines	–	–	–
Tanks	4	–	–
Cranes, Overhead Traveling	14	1	5
Hoists (Incl. Jib and Rail Mounting)	123	30	5
Chain, hand	89	29	4
Electric	31	1	–
Pneumatic	3	1	1
Industrial Trucks	36	3	2
Lift	20	2	2
Truck-tractor	1	–	–
Powered hand trucks	14	–	–
Crane	1	1	–

ativeness of welding-equipment manufacturers and the rise of heat-treating during the depression.

Broadening of the types of equipment in instructional shops is indicated by the fact that only 5% of items in the category "Other Shop Equipment" are over 20 years old, while almost 50% of machine tools are more than 20 years old.

In an accompanying table, some of the typical large groups of machines have been separately analyzed. It is interesting to note that in such groups as electric welders and grinders, more than 80% of the equipment is under ten years old, and less than 10% is over 20; while in familiar machine tools like lathes and milling machines, only about 70% are under ten years old, and almost 20% are over 20 years old.

MOST MAINTENANCE EQUIPMENT IS OUTMODED

First study ever made of age and distribution of metalworking equipment for maintenance shows 63% of machine tools and 60% of metal-forming equipment are at least 10 years old

THE average maintenance shop has much poorer equipment than the average production shop. This condition, long thought to be the case, is clearly revealed in a special survey of maintenance shops outside the metalworking industry which was taken in conjunction with the Mid-Century Inventory.

The evidence of this survey points inescapably to the fact that management gives too little attention to the efficiency of equipment used for maintenance. This is further confirmed by the surprising number of large firms in these industries that had no idea what maintenance equipment their plants had, or what its condition was, until they began to collect the data for this survey.

There are an estimated 193,500 machine tools used for maintenance in these industries. Of these 63% are at least 10 years old and 42% are more than 20 years old.

Of an estimated 45,600 units of metal-forming equipment, 60% are at least 10 years old and 40% more than 20 years old.

Other shop equipment is estimated at 146,000 units with 46% at least 10 years old and 20% more than 20 years old.

As would be expected, the Air Transport industry is in the best position, with only 14% of its equipment as much as 10 years old. But then this industry has grown so much in the last decade that it has not had time to let its equipment become outmoded.

The worst record is, again not unexpectedly, the railroad shops. Here, 83% of the machine tools and 91% of the metal-forming equipment is at least 10 years old. Worse, 69 and 79%, respectively, are more than 20 years old. It should be remembered that most railroads are in the midst of a conversion to diesel operation, which should bring considerable modernization to their shops.

The two major categories of manufactured articles and process industries may look relatively good in comparison with the other maintenance groups, but they look bad in comparison with most of the divisions of production equipment (compare with chart, page 134).

A surprising result is apparent in the Primary Metals industry. This industry, closely allied with Metalworking, is in worse shape than anything except Public Utilities and Railroads.

Questionnaires similar to those for the Mid-Century Inventory were filled out by a group of plants in each of the seven types of industry shown in the table below. These detailed reports are summarized for each industry in the tables on the following pages.

With the exception of Railroads, no attempt was made to expand the data because, unlike production equipment, there is no uniform relationship between either the number of employees and the number of machines, or the volume produced and the number of machines.

For example, one company producing cigarettes might do all its own maintenance work while another, of almost equal size, might have all repair parts made on the outside. (The railroad data were expanded because of the very large sample obtained and the fact that virtually all railroads do their own maintenance.)

Rough estimates of the total quantity of equipment in each major class have been made from the samples. These estimates are shown below together with the percentage of equipment at least 10 years old and more than 20 years old.

Maintenance equipment in Metalworking is not included in this survey, because it is included with production equipment in the regular inventory.

There is some metalworking maintenance in other places not covered by this survey. For example, large department stores, hotels, hospitals, and construction firms may have small machine shops. Large bus and truck fleet operators maintain repair facilities, but here the equipment is mostly of a specialized nature.

Actually the estimates for the industries included in this survey represent nearly all metalworking equipment outside the metalworking industry. Exceptions are certain types of equipment, such as plastics-molding machinery, hoists, and industrial trucks, which are widely used in other industries.

SURVEY OF MAINTENANCE EQUIPMENT

	MACHINE TOOLS			METAL FORMING EQUIPMENT			OTHER SHOP EQUIPMENT			TOTAL		
	Estimated Quantity	10 yr & over	over 20 yr	Estimated Quantity	10 yr & over	over 20 yr	Estimated Quantity	10 yr & over	over 20 yr	Estimated Quantity	10 yr & over	over 20 yr
Railroads	31,050	83%	69%	8,200	91%	79%	18,900	72%	52%	58,150	81%	65%
Air Transport	1,400	15	1	450	17	0	900	11	..	2,750	14	1
Public Utilities	22,900	81	71	4,450	79	72	18,800	53	36	46,150	70	57
Mining & Lumbering	13,850	61	43	2,350	68	57	10,700	46	10	26,900	56	35
Manufactured Articles	67,200	54	28	16,500	41	19	44,350	31	6	128,050	44	19
Process Industries	34,500	52	26	8,200	55	24	36,700	46	11	79,400	50	19
Primary Metals	22,600	66	44	5,450	67	42	16,250	50	27	44,300	60	38
Total	193,500	63	42	45,600	60	40	146,600	46	20	385,700	56	34

Railroad Maintenance

	Units	10 yr & over	Over 20 yr
Machine Tools	31,045	83%	69%
Metal Forming	8,179	91	79
Other Equip.	18,869	72	52
Total	58,013	81	65

The data in this table have been expanded to represent total holdings of equipment in maintenance shops of railroads in the United States. These railroads employ approximately 1,350,000 people in both operating and non-operating departments.

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	31,045	4,416	21,349
Boring Machines	1,967	305	1,248
Horizontal boring, drilling, and milling	392	72	265
Vertical boring mills including vertical turret lathes	1,323	160	854
Precision, horizontal and vertical	21	–	6
Jig boring, horizontal and vertical	21	3	9
Other	210	70	114
Broaching Machines	9	–	9
Horizontal internal	–	–	–
Horizontal surface	–	–	–
Vertical internal	–	–	–
Vertical surface	3	–	3
Other	6	–	6
Contour sawing and filing	–	–	–
Cutoff Machines	1,334	239	623
Bandsaw	282	55	93
Abrasive disk	27	3	9
Hacksaws	650	120	271
Rotary, hot or cold	300	38	230
Other	75	23	20
Drilling Machines	4,871	701	3,267
Sensitive	484	47	303
Upright: Single-spindle	2,658	382	1,862
Gang	105	6	73
Radial	1,385	251	945
Multi-spindle cluster, adjustable & fixed center	29	3	20
Unit head and way type, multi-spindle	9	3	6
Deep-hole drills	–	–	–
Other	201	9	58
Gear Cutting and Finishing Machines	59	9	44
Hobbing machines	6	3	–
Shapers, gear	23	3	20
Cutters, form-milling type	3	–	3
Bevel gear cutters (not planer)	9	–	6
Cutters, planer type	–	–	–
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	15	3	12
Gear Checking Machines	–	–	–
Grinding Machines	7,527	1,051	5,121
External cylindrical, plain and universal	306	55	143
Internal cylindrical	886	15	845
Centerless: External	38	9	23
Internal	6	3	–
Surface: Rotary table type	44	15	26
Reciprocating type	157	26	102
Disk, horizontal and vertical	108	9	67
Tool and cutter	849	140	461
Bench, floor-stand, and snag	4,490	621	3,142
Abrasive belt (not polishing)	15	–	3
Other	628	158	309
Honing and Lapping	39	12	18
Honing	12	–	3
Lapping: External	12	6	6
Internal	3	–	3
Surface	12	6	6
Lathes	8,353	1,210	6,032
Bench and floor, light-duty	666	76	511
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	5,321	723	3,980
Turret lathes: Ram type and hand screw	583	93	385
Saddle type	508	85	371
Automatic chucking, horizontal and vertical	15	–	3
Automatic between-centers chucking	26	–	26
Automatic screw machines, bar	91	9	82
Gun and shaft boring	–	–	–
Other	1,143	224	674
Milling Machines	1,011	164	719
Bench type	6	–	3
Hand	9	–	6
Knee-type, horizontal	362	32	289
Vertical	231	18	193
Automatic and manufacturing	73	–	44
Bed (Lincoln) type, incl automatic rise and fall	3	–	3
Planer type	135	47	79
Die sinkers (except engraving) & duplicators	12	6	6
Other	180	61	96
Planers	1,098	94	954
Double housing	812	47	762
Openside	132	15	105
Other	154	32	87
Pipe Cutting and Threading Machines	1,084	189	539
Polishing and Buffing Machines	241	56	100
Speed lathes	47	–	15
Polishing stands	164	47	76
Abrasive belt	18	9	3
Other	12	–	6
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	1,701	184	1,316
Horizontal	1,281	137	972
Vertical, including slotters	402	44	338
Keyseaters	18	3	6

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	1,413	167	1,114
Tapping	126	47	79
Hobbing and milling	3	–	3
Die type	1,082	108	854
Grinders, thread	–	–	–
Rolling machines, thread	3	–	3
Other	199	12	175
Other Machine Tools	338	35	245
METAL FORMING MACHINERY	8,179	950	6,487
Bending and Forming Machines	1,356	201	948
Bending rolls, sheet and plate	585	64	486
Bending rolls, bars and shapes	38	3	29
Power bending brakes	254	76	96
Rotary forming machines	38	6	20
Bending machines, pipe and bar	136	26	90
Other	305	26	227
Hydraulic Presses	1,630	232	1,198
Vertical, single action	846	117	595
Vertical, double and triple action	35	9	26
Horizontal	420	64	309
Other (including hydro-pneumatic)	329	32	265
Pneumatic Presses (except hydro-pneumatic)	257	47	210
Mechanical Presses, Power Driven	194	6	170
Inclinable	15	–	12
Vertical, C-frame	18	–	15
Vertical, straight-sided	35	–	32
Dieing machines	20	–	20
Horizontal	9	–	9
Other	97	6	82
Punching and Shearing Machines	2,583	275	2,124
Punching machines	974	99	808
Plate and sheet shears	999	104	819
Bar and angle shears	219	17	196
Rotary shears	96	20	70
Other	295	35	231
Forging Machinery (except presses)	1,906	175	1,654
Hammers, steam or air	1,033	108	907
Hammers, gravity drop	53	3	38
Hammers, helve	294	26	251
Forging machines (headers) and rolls	412	32	362
Other	114	6	96
Swaging Machines	122	9	70
Wire and Strip Forming Machines	–	–	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	131	15	96
OTHER SHOP EQUIPMENT	18,869	3,753	9,759
Electric Welding Machines (Not Hand)	1,872	703	749
Arc: Motor-generator set	1,403	635	566
Transformer	134	3	44
Automatic and other	140	18	61
Resistance: Spot	70	15	20
Projection	–	–	–
Gun	3	–	–
Seam	3	–	3
Butt and flash	119	32	55
Gas Welding, Cutting Machines (Not Hand)	190	44	41
Flame cutting	178	44	35
Welding	12	–	6
Balancing Machines	69	8	6
Air Compressors	1,647	231	1,022
Plating Equipment	141	30	38
Machines	30	18	12
Tanks	108	12	26
Barrels	3	–	–
Materials Heating Equipment	2,160	423	1,382
Heat-treating furnaces	629	119	406
Stock-heating furnaces	1,242	248	854
Salt baths	64	6	23
Induction heating units	44	3	3
Baking and drying ovens	114	41	58
Flame hardening	67	6	38
Cleaning Equipment	427	86	164
Tumbling barrels	100	9	85
Shot and abrasive blast	99	15	29
Parts washing machines	79	15	12
Pickling machines	6	–	–
Tanks	143	47	38
Cranes, Overhead Traveling	1,574	268	1,194
Hoists (Incl. Jib and Rail Mounting)	7,145	1,318	4,105
Chain, hand	3,287	563	2,242
Electric	2,307	338	938
Pneumatic	1,551	417	825
Industrial Trucks	3,644	642	1,058
Lift	1,044	224	210
Truck-tractor	990	161	347
Powered hand trucks	557	61	64
Crane	1,053	196	437

Air Transport

	Units	10 yr & over	Over 20 yr
Machine Tools	666	15%	1%
Metal Forming	218	17	0
Other Equip.	417	11	0
Total	1,301	14	1

The data in this table represent 53% (by total employment) of the airlines in the United States. In addition, this table includes a small percentage of the contract aircraft maintenance firms. For the estimated totals on page 216, it has been assumed that these data represent 47.6% of the total of airlines and contract shops.

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	666	91	10
Boring Machines	12	–	–
Horizontal boring, drilling, and milling	3	–	–
Vertical boring mills (including vertical turret lathes	1	–	–
Precision, horizontal and vertical	6	–	–
Jig boring, horizontal and vertical	1	–	–
Other	1	–	–
Broaching Machines	8	–	–
Horizontal internal	2	–	–
Horizontal surface	2	–	–
Vertical internal	–	–	–
Vertical surface	–	–	–
Other	4	–	–
Contour sawing and filing	4	–	–
Cutoff Machines	59	6	–
Bandsaw	20	2	–
Abrasive disk	7	–	–
Hacksaws	12	1	–
Rotary, hot or cold	6	1	–
Other	14	2	–
Drilling Machines	146	14	–
Sensitive	5	1	–
Upright: Single-spindle	55	10	–
Gang	1	–	–
Radial	10	–	–
Multi-spindle cluster, adjustable & fixed center	2	–	–
Unit head and way type, multi-spindle	2	–	–
Deep-hole drills	40	–	–
Other	31	3	–
Gear Cutting and Finishing Machines	2	–	–
Hobbing machines	–	–	–
Shapers, gear	–	–	–
Cutters, form-milling type	–	–	–
Bevel gear cutters (not planer)	–	–	–
Cutters, planer type	–	–	–
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	2	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	–	–	–
Grinding Machines	226	43	1
External cylindrical, plain and universal	16	2	–
Internal cylindrical	14	5	–
Centerless: External	–	–	–
Internal	1	–	–
Surface: Rotary table type	20	5	–
Reciprocating type	3	–	–
Disk, horizontal and vertical	8	2	–
Tool and cutter	8	2	–
Bench, floorstand, and snag	95	10	1
Abrasive belt (not polishing)	10	1	–
Other	51	16	–
Honing and Lapping	24	4	–
Honing	8	3	–
Lapping: External	4	–	–
Internal	7	1	–
Surface	5	–	–
Lathes	96	17	8
Bench and floor, light-duty	36	12	2
Engine, heavy-duty, incl toolroom, mfg, aut lorn, gap	29	4	5
Turret lathes: Ram type and hand screw	12	1	1
Saddle type	2	–	–
Automatic chucking, horizontal and vertical	2	–	–
Automatic between centers chucking	2	–	–
Automatic screw machines, bar	6	–	–
Gun and shaft boring	–	–	–
Other	7	–	–
Milling Machines	26	–	1
Bench type	5	–	–
Hand	2	–	–
Knee-type, horizontal	6	–	1
Vertical	4	–	–
Automatic and manufacturing	3	–	–
Bed (Lincoln) type, incl automatic rise and fall	–	–	–
Planer type	2	–	–
Die sinkers (except engraving) & duplicators	–	–	–
Other	4	–	–
Planers	6	2	–
Double housing	–	–	–
Openside	1	1	–
Other	5	1	–
Pipe Cutting and Threading Machines	5	1	–
Polishing and Buffing Machines	29	2	–
Speed lathes	9	1	–
Polishing stands	10	1	–
Abrasive belt	4	–	–
Other	6	–	–
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	9	2	–
Horizontal	7	2	–
Vertical, including slotters	2	–	–
Keyseaters	–	–	–

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	14	–	–
Tapping	1	–	–
Hobbing and milling	2	–	–
Die type	2	–	–
Grinders, thread	4	–	–
Rolling machines, thread	2	–	–
Other	3	–	–
Other Machine Tools	–	–	–
METAL FORMING MACHINERY	218	36	1
Bending and Forming Machines	75	20	–
Bending rolls, sheet and plate	19	5	–
Bending rolls, bars and shapes	2	–	–
Power bending brakes	11	2	–
Rotary forming machines	10	2	–
Bending machines, pipe and bar	7	1	–
Other	26	10	–
Hydraulic Presses	22	3	–
Vertical, single action	11	–	–
Vertical, double and triple action	6	3	–
Horizontal	5	–	–
Other (including hydro-pneumatic)	–	–	–
Pneumatic Presses (except hydro-pneumatic)	6	–	–
Mechanical Presses, Power Driven	20	–	–
Inclinable	2	–	–
Vertical, C-frame	2	–	–
Vertical, straight-sided	6	–	–
Dieing machines	2	–	–
Horizontal	8	–	–
Other	–	–	–
Punching and Shearing Machines	58	8	1
Punching machines	10	2	1
Plate and sheet shears	17	3	–
Bar and angle shears	3	–	–
Rotary shears	10	–	–
Other	18	3	–
Forging Machinery (except presses)	13	2	–
Hammers, steam or air	3	–	–
Hammers, gravity drop	3	1	–
Hammers, helve	–	–	–
Forging machines (headers) and rolls	3	–	–
Other	4	1	–
Swaging Machines	11	–	–
Wire and Strip Forming Machines	2	–	–
Die Casting Machines	2	–	–
Hot chamber	1	–	–
Cold chamber	1	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	9	3	–
OTHER SHOP EQUIPMENT	417	47	–
Electric Welding Machines (Not Hand)	29	–	–
Arc: Motor-generator set	9	–	–
Transformer	3	–	–
Automatic and other	7	–	–
Resistance: Spot	8	–	–
Projection	–	–	–
Gun	1	–	–
Seam	–	–	–
Butt and flash	1	–	–
Gas Welding, Cutting Machines (Not Hand)	5	–	–
Flame cutting	2	–	–
Welding	3	–	–
Balancing Machines	10	2	–
Air Compressors	17	5	–
Plating Equipment	56	–	–
Machines	3	–	–
Tanks	45	–	–
Barrels	8	–	–
Materials Heating Equipment	44	5	–
Heat-treating furnaces	18	3	–
Stock-heating furnaces	3	–	–
Salt baths	2	–	–
Induction heating units	5	–	–
Baking and drying ovens	15	2	–
Flame hardening	1	–	–
Cleaning Equipment	59	6	–
Tumbling barrels	1	–	–
Shot and abrasive blast	14	1	–
Parts washing machines	10	–	–
Pickling machines	1	–	–
Tanks	33	5	–
Cranes, Overhead Traveling	4	–	–
Hoists (Incl. Jib and Rail Mounting)	121	20	–
Chain, hand	80	17	–
Electric	29	2	–
Pneumatic	12	1	–
Industrial Trucks	72	9	–
Lift	29	2	–
Truck-tractor	25	3	–
Powered hand trucks	10	3	–
Crane	8	1	–

Public Utilities

	Units	10 yr & over	Over 20 yr
Machine Tools	**564**	**81%**	**71%**
Metal Forming	**110**	**79**	**72**
Other Equip.	**462**	**53**	**36**
Total	**1,136**	**70**	**57**

The data in this table represent 2.5% (by number of employees) of the public utilities in the United States. These include public and private electric and gas companies, communications, street railways, bus and trolley-bus lines.

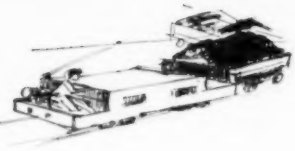
	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	564	58	400
Boring Machines	20	2	18
Horizontal boring, drilling, and milling	8	–	8
Vertical boring mills (including vertical turret lathes)	12	2	10
Precision, horizontal and vertical	–	–	–
Jig boring, horizontal and vertical	–	–	–
Other	–	–	–
Broaching Machines	–	–	–
Horizontal internal	–	–	–
Horizontal surface	–	–	–
Vertical internal	–	–	–
Vertical surface	–	–	–
Other	–	–	–
Contour sawing and filing	–	–	–
Cutoff Machines	45	6	21
Bandsaw	10	–	2
Abrasive disk	2	1	1
Hacksaws	25	3	16
Rotary, hot or cold	6	2	2
Other	1	–	–
Drilling Machines	125	7	96
Sensitive	8	–	4
Upright: Single-spindle	72	5	53
Gang	6	–	4
Radial	24	2	19
Multi-spindle cluster, adjustable & fixed center	4	–	4
Unit head and way type, multi-spindle	–	–	–
Deep-hole drills	–	–	–
Other	13	–	10
Gear Cutting and Finishing Machines	–	–	–
Hobbing machines	–	–	–
Shapers, gear	–	–	–
Cutters, form-milling type	–	–	–
Bevel gear cutters (not planer)	–	–	–
Cutters, planer type	–	–	–
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	–	–	–
Grinding Machines	164	31	106
External cylindrical, plain and universal	3	2	1
Internal cylindrical	–	–	–
Centerless: External	–	–	–
Internal	–	–	–
Surface: Rotary table type	4	2	–
Reciprocating type	–	–	–
Disk, horizontal and vertical	4	–	4
Tool and cutter	13	6	7
Bench, floorstand, and snag	125	20	89
Abrasive belt (not polishing)	–	–	–
Other	13	1	5
Honing and Lapping	2	–	–
Honing	2	–	–
Lapping: External	–	–	–
Internal	–	–	–
Surface	–	–	–
Lathes	118	5	94
Bench and floor, light-duty	14	–	9
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	87	5	70
Turret lathes: Ram type and hand screw	6	–	4
Saddle type	5	–	5
Automatic chucking, horizontal and vertical	–	–	–
Automatic between centers chucking	–	–	–
Automatic screw machines, bar	–	–	–
Gun and shaft boring	4	–	4
Others	2	–	2
Milling Machines	15	3	8
Bench type	–	–	–
Hand	–	–	–
Knee-type, horizontal	12	3	5
Vertical	2	–	2
Automatic and manufacturing	–	–	–
Bed (Lincoln) type, incl automatic raise and fall	–	–	–
Planer type	1	–	1
Die sinkers (except engraving) & duplicators	–	–	–
Other	–	–	–
Planers	8	–	7
Double housing	2	–	2
Openside	2	–	2
Other	4	–	3
Pipe Cutting and Threading Machines	36	2	23
Polishing and Buffing Machines	6	–	5
Speed lathes	4	–	4
Polishing stands	2	–	1
Abrasive belt	–	–	–
Other	–	–	–
Rifle Barring Machines (not deep-hole drills)	–	–	–
Shapers	18	2	15
Horizontal	17	2	14
Vertical, including slotters	–	–	–
Keyseaters	1	–	1

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	7	–	7
Tapping	–	–	–
Hobbing and milling	–	–	–
Die type	7	–	7
Grinders, thread	–	–	–
Rolling machines, thread	–	–	–
Other	–	–	–
Other Machine Tools	–	–	–
METAL FORMING MACHINERY	110	8	79
Bending and Forming Machines	38	3	29
Bending rolls, sheet and plate	13	–	11
Bending rolls, bars and shapes	–	–	–
Power bending brakes	8	1	7
Rotary forming machines	11	1	10
Bending machines, pipe and bar	5	1	1
Other	1	–	–
Hydraulic Presses	15	1	8
Vertical, single action	8	1	1
Vertical, double and triple action	–	–	–
Horizontal	6	–	6
Other (including hydro-pneumatic)	1	–	1
Pneumatic Presses (except hydro-pneumatic)	2	–	–
Mechanical Presses, Power Driven	–	–	–
Inclinable	–	–	–
Vertical, C-frame	–	–	–
Vertical, straight-sided	–	–	–
Dieing machines	–	–	–
Horizontal	–	–	–
Other	–	–	–
Punching and Shearing Machines	35	4	24
Punching machines	11	2	6
Plate and sheet shears	15	–	13
Bar and angle shears	2	–	2
Rotary shears	2	1	1
Other	5	1	2
Forging Machinery (except presses)	19	1	18
Hammers, steam or air	13	–	12
Hammers, gravity drop	–	–	–
Hammers, helve	–	–	–
Forging machines (headers) and rolls	2	–	2
Other	4	–	4
Swaging Machines	1	–	–
Wire and Strip Forming Machines	–	–	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	–	–	–
OTHER SHOP EQUIPMENT	462	77	167
Electric Welding Machines (Not Hand)	56	6	3
Arc: Motor-generator set	45	6	2
Transformer	7	–	–
Automatic and other	–	–	–
Resistance: Spot	4	–	1
Projection	–	–	–
Gun	–	–	–
Seam	–	–	–
Butt and flash	–	–	–
Gas Welding, Cutting Machines (Not Hand)	14	7	1
Flame cutting	2	1	1
Welding	12	6	–
Balancing Machines	4	2	1
Air Compressors	34	2	28
Plating Equipment	8	–	7
Machines	1	–	–
Tanks	4	–	4
Barrels	3	–	3
Materials Heating Equipment	20	3	10
Heat-treating furnaces	2	–	2
Stock-heating furnaces	6	–	4
Salt baths	–	–	–
Induction heating units	1	–	–
Baking and drying ovens	11	3	4
Flame hardening	–	–	–
Cleaning Equipment	28	6	5
Tumbling barrels	–	–	–
Shot and abrasive blast	6	2	–
Parts washing machines	6	–	–
Pickling machines	–	–	–
Tanks	16	4	5
Cranes, Overhead Traveling	18	5	10
Hoists (Incl. Jib and Rail Mounting)	251	42	94
Chain, hand	199	39	66
Electric	24	–	14
Pneumatic	28	3	14
Industrial Trucks	29	4	8
Lift	18	4	4
Truck-tractor	2	–	–
Powered hand trucks	2	–	–
Crane	6	–	4

Mining and Lumbering

	Units	10 yr & over	Over 20 yr
Machine Tools	207	61%	43%
Metal Forming	35	68	57
Other Equip.	160	46	19
Total	402	56	35

The data in this table represent 1.5% (by number of employees) of the firms engaged in mining and lumbering operations in the United States.



	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	207	34	68
Boring Machines	8	–	6
Horizontal boring, drilling, and milling	2	–	1
Vertical boring mills (including vertical turret lathes	5	–	5
Precision, horizontal and vertical	1	–	–
Jig boring, horizontal and vertical	–	–	–
Other	–	–	–
Broaching Machines	–	–	–
Horizontal internal	–	–	–
Horizontal surface	–	–	–
Vertical internal	–	–	–
Vertical surface	–	–	–
Other	–	–	–
Contour sawing and filing	–	–	–
Cutoff Machines	24	5	4
Bandsaw	10	1	1
Abrasive disk	–	–	–
Hacksaws	12	4	2
Rotary, hot or cold	–	–	–
Other	2	–	1
Drilling Machines	34	4	14
Sensitive	–	–	1
Upright: Single-spindle	17	1	6
Gang	–	–	–
Radial	9	3	4
Multi-spindle cluster, adjustable & fixed center	3	–	2
Unit head and way type, multi-spindle	–	–	–
Deep-hole drills	–	–	–
Other	3	–	1
Gear Cutting and Finishing Machines	1	1	–
Hobbing machines	–	–	–
Shapers, gear	1	1	–
Cutters, form-milling type	–	–	–
Bevel gear cutters (not planer)	–	–	–
Cutters, planer type	–	–	–
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	–	–	–
Grinding Machines	43	2	15
External cylindrical, plain and universal	1	–	1
Internal cylindrical	–	–	–
Centerless: External	–	–	–
Internal	–	–	–
Surface: Rotary table type	–	–	–
Reciprocating type	–	–	–
Disk, horizontal and vertical	2	–	2
Tool and cutter	6	1	–
Bench, floorstand, and snag	30	1	10
Abrasive belt (not polishing)	–	–	–
Other	4	–	2
Honing and Lapping	1	–	–
Honing	1	–	–
Lapping: External	–	–	–
Internal	–	–	–
Surface	–	–	–
Lathes	51	11	27
Bench and floor, light-duty	14	7	–
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	35	4	27
Turret lathes: Ram type and hand screw	–	–	–
Saddle type	–	–	–
Automatic chucking, horizontal and vertical	–	–	–
Automatic between centers chucking	–	–	–
Automatic screw machines, bar	1	–	–
Gun and shaft boring	–	–	–
Other	–	–	–
Milling Machines	10	3	2
Bench type	1	1	–
Hand	–	–	–
Knee-type, horizontal	8	2	2
Vertical	–	–	–
Automatic and manufacturing	–	–	–
Bed (Lincoln) type, incl automatic rise and fall	–	–	–
Planer type	1	–	–
Die sinkers (except engraving) & duplicators	–	–	–
Other	–	–	–
Planers	6	1	5
Double housing	5	1	4
Openside	1	–	1
Other	–	–	–
Pipe Cutting and Threading Machines	9	3	4
Polishing and Buffing Machines	–	–	–
Speed lathes	–	–	–
Polishing stands	–	–	–
Abrasive belt	–	–	–
Other	–	–	–
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	15	4	7
Horizontal	12	4	5
Vertical, including slotters	1	–	1
Keyseaters	2	–	1

	TOTAL	10–20 YEARS	OVER 20 YR
Threading (except pipe)	4	–	4
Tapping	–	–	–
Hobbing and milling	–	–	–
Die type	4	–	4
Grinders, thread	–	–	–
Rolling machines, thread	–	–	–
Other	–	–	–
Other Machine Tools	1	–	1
METAL FORMING MACHINERY	35	4	20
Bending and Forming Machines	3	1	1
Bending rolls, sheet and plate	2	–	1
Bending rolls, bars and shapes	–	–	–
Power bending brakes	–	–	–
Rotary forming machines	–	–	–
Bending machines, pipe and bar	1	1	–
Other	–	–	–
Hydraulic Presses	12	1	6
Vertical, single action	2	–	1
Vertical, double and triple action	1	–	1
Horizontal	9	1	4
Other (including hydro-pneumatic)	–	–	–
Pneumatic Presses (except hydro-pneumatic)	–	–	–
Mechanical Presses, Power Driven	2	–	1
Inclinable	1	–	–
Vertical, C-frame	–	–	–
Vertical, straight-sided	1	–	1
Dieing machines	–	–	–
Horizontal	–	–	–
Other	–	–	–
Punching and Shearing Machines	11	2	5
Punching machines	4	–	1
Plate and sheet shears	3	–	2
Bar and angle shears	–	–	1
Rotary shears	2	1	–
Other	2	1	1
Forging Machinery (except presses)	6	–	6
Hammers, steam or air	5	–	5
Hammers, gravity drop	–	–	–
Hammers, helve	1	–	1
Forging machines (headers) and rolls	–	–	–
Other	–	–	–
Swaging Machines	–	–	–
Wire and Strip Forming Machines	–	–	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	–	–	1
OTHER SHOP EQUIPMENT	160	43	31
Electric Welding Machines (Not Hand)	37	8	1
Arc: Motor-generator set	27	6	1
Transformer	7	2	–
Automatic and other	–	–	–
Resistance: Spot	2	–	–
Projection	–	–	–
Gun	–	–	–
Seam	–	–	–
Butt and flash	1	–	–
Gas Welding, Cutting Machines (Not Hand)	9	3	–
Flame cutting	8	3	–
Welding	1	–	–
Balancing Machines	2	2	–
Air Compressors	28	9	5
Plating Equipment	–	–	–
Machines	–	–	–
Tanks	–	–	–
Barrels	–	–	–
Materials Heating Equipment	4	1	2
Heat-treating furnaces	1	–	–
Stock-heating furnaces	1	1	–
Salt baths	–	–	–
Induction heating units	–	–	–
Baking and drying ovens	2	–	2
Flame hardening	–	–	–
Cleaning Equipment	6	1	2
Tumbling barrels	1	–	1
Shot and abrasive blast	–	–	–
Parts washing machines	4	1	–
Pickling machines	–	–	–
Tanks	1	–	1
Cranes, Overhead Traveling	14	–	12
Hoists (Incl. Jib and Rail Mounting)	40	18	8
Chain, hand	27	10	7
Electric	12	8	–
Pneumatic	1	–	1
Industrial Trucks	20	1	1
Lift	6	–	–
Truck-tractor	8	–	1
Powered hand trucks	1	–	–
Crane	5	1	–

Manufactured Articles

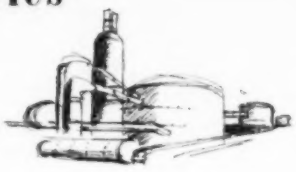
	Units	10 yr & over	Over 20 yr
Machine Tools	1,793	54%	28%
Metal Forming	441	41	19
Other Equip.	1,186	31	6
Total	3,420	44	19

The data in this table represent 2.7% (by number of employees) of the firms making the following types of products: Food and Kindred Products (Standard Industry Classification 20), Tobacco Products (21), Textile-Mill Products (22), Apparel (23), Leather Products (31), and Stone, Clay, and Glass Products (32).

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	1,793	467	509
Boring Machines	36	5	19
Horizontal boring, drilling, and milling	14	1	8
Vertical boring mills including vertical turret lathes	14	3	9
Precision, horizontal and vertical	–	–	–
Jig boring, horizontal and vertical	3	–	–
Other	5	1	2
Broaching Machines	3	–	1
Horizontal internal	1	–	1
Horizontal surface	–	–	–
Vertical internal	1	–	–
Vertical surface	–	–	–
Other	1	–	–
Contour sawing and filing	18	1	1
Cutoff Machines	179	53	27
Bandsaw	39	3	1
Abrasive disk	15	5	1
Hacksaws	99	37	20
Rotary, hot or cold	6	3	–
Other	20	5	5
Drilling Machines	329	67	110
Sensitive	41	11	5
Upright: Single-spindle	216	38	85
Gang	4	2	1
Radial	40	9	15
Multi-spindle cluster, adjustable & fixed center	4	2	–
Unit head and way type, multi-spindle	1	–	1
Deep-hole drills	–	–	–
Other	23	5	3
Gear Cutting and Finishing Machines	23	9	11
Hobbing machines	5	1	2
Shapers, gear	7	2	5
Cutters, form-milling type	6	4	2
Bevel gear cutters (not planer)	2	1	–
Cutters, planer type	3	1	2
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	–	–	–
Grinding Machines	369	96	52
External cylindrical, plain and universal	27	7	6
Internal cylindrical	5	3	–
Centerless: External	7	–	–
Internal	–	–	–
Surface: Rotary table type	17	4	2
Reciprocating type	22	5	1
Disk, horizontal and vertical	6	–	1
Tool and cutter	39	7	8
Bench, floor-stand, and snag	212	63	33
Abrasive belt (not polishing)	10	2	–
Other	24	5	1
Honing and Lapping	4	1	–
Honing	3	–	–
Lapping: External	1	1	–
Internal	–	–	–
Surface	–	–	–
Lathes	441	120	158
Bench and floor, light-duty	110	31	36
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	266	66	115
Turret lathes: Ram type and hand screw	25	7	4
Saddle type	14	9	1
Automatic chucking, horizontal and vertical	1	1	–
Automatic between centers chucking	2	–	–
Automatic screw machines, bar	–	–	–
Gun and shaft boring	–	–	–
Other	23	6	2
Milling Machines	115	35	34
Bench type	1	–	–
Hand	11	4	5
Knee-type, horizontal	52	11	22
Vertical	30	8	3
Automatic and manufacturing	5	–	3
Bed (Lincoln) type, incl automatic rise and fall	–	–	–
Planer type	2	1	1
Die sinkers (except engraving) & duplicators	4	2	–
Other	10	9	–
Planers	27	7	18
Double housing	12	2	10
Openside	9	2	5
Other	6	3	3
Pipe Cutting and Threading Machines	91	23	24
Polishing and Buffing Machines	47	13	6
Speed lathes	23	12	4
Polishing stands	9	1	2
Abrasive belt	8	–	–
Other	7	–	–
Rifle Working Machines (not deep-hole drills)	–	–	–
Shapers	94	30	40
Horizontal	69	21	32
Vertical, including slotters	7	4	2
Keyseaters	18	5	6
Threading (except pipe)	17	7	8
Tapping	4	4	–
Hobbing and milling	–	–	–
Die type	8	1	7
Grinders, thread	1	–	–
Rolling machines, thread	1	1	–
Other	3	1	1
Other Machine Tools	–	–	–
METAL FORMING MACHINERY	441	95	84
Bending and Forming Machines	119	20	23
Bending rolls, sheet and plate	54	12	16
Bending rolls, bars and shapes	7	–	3
Power bending brakes	15	4	1
Rotary forming machines	6	–	–
Bending machines, pipe and bar	23	3	2
Other	14	1	1
Hydraulic Presses	106	31	16
Vertical, single action	65	18	11
Vertical, double and triple action	9	3	1
Horizontal	6	1	3
Other (including hydro-pneumatic)	26	9	1
Pneumatic Presses (except hydro-pneumatic)	2	–	–
Mechanical Presses, Power Driven	109	28	13
Inclinable	92	24	10
Vertical, C-frame	4	2	1
Vertical, straight-sided	7	1	–
Dieing machines	3	1	–
Horizontal	–	–	–
Other	3	–	2
Punching and Shearing Machines	72	8	24
Punching machines	21	2	7
Plate and sheet shears	36	6	8
Bar and angle shears	7	–	5
Rotary shears	5	–	2
Other	3	–	2
Forging Machinery (except presses)	10	3	7
Hammers, steam or air	2	–	2
Hammers, gravity drop	3	–	3
Hammers, helve	1	–	1
Forging machines (headers) and rolls	–	–	–
Other	4	3	1
Swaging Machines	3	–	1
Wire and Strip Forming Machines	16	5	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	4	–	–
OTHER SHOP EQUIPMENT	1,186	304	69
Electric Welding Machines (Not Hand)	144	38	2
Arc: Motor-generator set	110	34	1
Transformer	12	–	–
Automatic and other	10	4	–
Resistance: Spot	10	–	–
Projection	1	–	1
Gun	–	–	–
Seam	–	–	–
Butt and flash	1	–	–
Gas Welding, Cutting Machines (Not Hand)	62	16	2
Flame cutting	9	–	–
Welding	53	16	2
Balancing Machines	12	3	1
Air Compressors	130	32	29
Plating Equipment	9	3	–
Machines	2	1	–
Tanks	7	2	–
Barrels	–	–	–
Materials Heating Equipment	87	13	4
Heat-treating furnaces	34	5	3
Stock-heating furnaces	2	2	–
Salt baths	6	1	–
Induction heating units	2	–	–
Baking and drying ovens	41	4	1
Flame hardening	2	1	–
Cleaning Equipment	30	4	1
Tumbling barrels	6	4	–
Shot and abrasive blast	8	–	1
Parts washing machines	10	–	–
Pickling machines	–	–	–
Tanks	6	–	–
Cranes, Overhead Traveling	32	16	2
Hoists (Incl. Jib and Rail Mounting)	311	70	21
Chain, hand	170	42	19
Electric	127	16	2
Pneumatic	14	12	–
Industrial Trucks	369	109	7
Lift	213	80	7
Truck-tractor	48	13	–
Powered hand trucks	103	16	–
Crane	5	–	–

Process Industries

	Units	10 yr & over	Over 20 yr
Machine Tools	**3,165**	**52%**	**26%**
Metal Forming	**755**	**55**	**24**
Other Equip.	**3,370**	**46**	**11**
Total	**7,290**	**50**	**19**



The data in this table represent 9.2% (by number of employees) of the firms in the following fields: Paper and Allied Products (Standard Industry Classification 26), Printing and Publishing (27), Chemicals and Allied Products (28), Petroleum and Coal Products (29), and Rubber Products (30).

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	3,165	812	837
Boring Machines	46	9	23
Horizontal boring, drilling, and milling	12	3	5
Vertical boring mills including vertical turret lathes	25	5	15
Precision, horizontal and vertical	3	1	1
Jig boring, horizontal and vertical	4	–	–
Other	2	–	2
Broaching Machines	22	3	2
Horizontal internal	–	–	–
Horizontal surface	1	–	1
Vertical internal	1	–	1
Vertical surface	–	–	–
Other	–	–	–
Contour sawing and filing	20	3	–
Cutoff Machines	162	84	37
Bandsaw	93	20	7
Abrasive disk	10	7	–
Hacksaw	132	51	29
Rotary, hot or cold	16	5	1
Other	6	1	–
Drilling Machines	661	154	197
Sensitive	60	11	13
Upright: Single-spindle	473	111	144
Gang	14	3	7
Radial	76	20	28
Multi-spindle cluster, adjustable & fixed center	3	–	2
Unit head and way type, multi-spindle	1	–	1
Deep-hole drills	–	–	–
Other	14	9	2
Gear Cutting and Finishing Machines	6	–	6
Hobbing machines	–	–	–
Shapers, gear	–	–	–
Cutters, form-milling type	–	–	3
Bevel gear cutters (not planer)	1	–	1
Cutters, planer type	2	–	2
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	–	–	–
Gear Checking Machines	–	–	–
Grinding Machines	751	200	98
External cylindrical, plain and universal	62	23	14
Internal cylindrical	9	3	1
Centerless: External	1	–	1
Internal	–	–	–
Surface: Rotary table type	23	3	1
Reciprocating type	35	8	3
Disk, horizontal and vertical	14	3	2
Tool and cutter	83	17	8
Bench, floor-stand, and snag	476	129	64
Abrasive belt (not polishing)	28	4	–
Other	28	12	2
Honing and Lapping	15	3	4
Honing	4	2	–
Lapping: External	2	–	2
Internal	–	–	–
Surface	9	1	2
Lathes	690	178	224
Bench and floor, light-duty	224	62	55
Engine, heavy-duty, incl toolroom, mfg, aut form, gap	409	105	154
Turret lathes: Ram type and hand screw	26	6	7
Saddle type	6	3	1
Automatic chucking, horizontal and vertical	–	–	–
Automatic between centers chucking	2	–	2
Automatic screw machines, bar	8	1	3
Gun and shaft boring	11	–	1
Other	4	1	1
Milling Machines	180	45	63
Bench type	8	3	1
Hand	13	6	4
Knee-type, horizontal	100	24	39
Vertical	32	8	9
Automatic and manufacturing	1	–	1
Bed (Lincoln) type, incl automatic rise and fall	2	1	–
Planer type	12	2	4
Die sinkers (except engraving) & duplicators	2	–	1
Other	10	1	4
Planers	32	5	26
Double housing	20	1	19
Openside	7	4	2
Other	5	–	5
Pipe Cutting and Threading Machines	247	63	59
Polishing and Buffing Machines	69	23	17
Speed lathes	12	2	5
Polishing stands	24	12	10
Abrasive belt	19	6	2
Other	2	3	–
Rifle Barking Machines (not deep-hole drills)	1	1	–
Shapers	129	30	64
Horizontal	111	23	56
Vertical, including slotters	6	2	3
Keyseaters	12	5	5
Threading (except pipe)	44	12	13
Tapping	4	1	–
Hobbing and milling	–	–	–
Die type	36	8	12
Grinders, thread	–	–	–
Rolling machines, thread	–	–	–
Other	4	3	1
Other Machine Tools	10	2	4
METAL FORMING MACHINERY	755	234	181
Bending and Forming Machines	240	121	43
Bending rolls, sheet and plate	157	98	28
Bending rolls, bars and shapes	6	–	2
Power bending brakes	12	5	2
Rotary forming machines	10	5	1
Bending machines, pipe and bar	36	7	5
Other	19	6	5
Hydraulic Presses	165	59	17
Vertical, single action	44	48	8
Vertical, double and triple action	43	6	–
Horizontal	22	5	8
Other (including hydro-pneumatic)	4	–	1
Pneumatic Presses (except hydro-pneumatic)	6	2	2
Mechanical Presses, Power Driven	100	10	44
Inclinable	48	3	26
Vertical, C-frame	21	4	10
Vertical, straight-side	25	1	8
Dieing machines	–	–	–
Horizontal	4	1	–
Other	2	1	–
Punching and Shearing Machines	146	29	55
Punching machines	42	9	22
Plate and sheet shears	55	6	17
Bar and angle shears	20	6	10
Rotary shears	14	4	5
Other	15	4	1
Forging Machinery (except presses)	20	2	15
Hammers, steam or air	12	2	9
Hammers, gravity drop	4	–	3
Hammers, helve	–	–	–
Forging machines (headers) and rolls	1	–	–
Other	3	–	3
Swaging Machines	2	2	–
Wire and Strip Forming Machines	3	–	–
Die Casting Machines	2	2	–
Hot chamber	2	2	–
Cold chamber	–	–	–
Plastic Molding Machines	52	5	–
Injection	45	4	–
Compression	7	1	–
Riveting Machines (Not Portable)	19	2	5
OTHER SHOP EQUIPMENT	3,370	1,184	365
Electric Welding Machines (Not Hand)	363	137	13
Arc: Motor-generator set	314	114	13
Transformer	14	4	–
Automatic and other	2	1	–
Resistance: Spot	14	6	–
Projection	–	–	–
Gun	2	–	–
Seam	–	–	–
Butt and flash	17	12	–
Gas Welding, Cutting Machines (Not Hand)	46	7	2
Flame cutting	25	5	2
Welding	21	2	–
Balancing Machines	10	–	2
Air Compressors	257	63	47
Plating Equipment	34	16	3
Machines	6	1	3
Tanks	25	16	–
Barrels	3	1	–
Materials Heating Equipment	88	28	8
Heat-treating furnaces	35	16	6
Stock-heating furnaces	4	1	1
Salt baths	13	7	–
Induction heating units	3	–	–
Baking and drying ovens	12	4	1
Flame hardening	1	–	–
Cleaning Equipment	75	19	7
Tumbling barrels	9	1	–
Shot and abrasive blast	27	10	2
Parts washing machines	24	7	3
Pickling machines	2	1	–
Tanks	13	–	2
Cranes, Overhead Traveling	66	22	27
Hoists (Incl. Jib and Rail Mounting)	2,048	848	207
Chain, hand	1,854	821	182
Electric	167	22	22
Pneumatic	27	5	3
Industrial Trucks	383	42	49
Lift	190	23	15
Truck-tractor	85	9	30
Powered hand trucks	76	8	–
Crane	32	5	4

Primary Metals

	Units	10 yr & over	Over 20 yr
Machine Tools	**3,672**	**66%**	**44%**
Metal Forming	**888**	**67**	**42**
Other Equip.	**2,648**	**50**	**27**
Total	**7,208**	**60**	**38**

The data in this table represent 16% (by number of employees) of the firms in the Primary Metal Industries (Standard Industry Classification 33) except foundries, forging plants, and plants making welded and heavy-riveted pipe. The plants not included here are included in the regular Inventory (see table, page 155).

	TOTAL	10–20 YEARS	OVER 20 YR
MACHINE TOOLS	3,672	775	1,633
Boring Machines	140	16	96
Horizontal boring, drilling, and milling	113	11	84
Vertical boring mills including vertical turret lathes	25	3	12
Precision, horizontal and vertical	–	–	–
Jig boring, horizontal and vertical	2	2	–
Other	–	–	–
Broaching Machines	5	3	2
Horizontal internal	2	–	2
Horizontal surface	–	–	–
Vertical internal	1	1	–
Vertical surface	–	–	–
Other	2	2	–
Contour sawing and filing	7	3	–
Cutoff Machines	372	102	85
Bandsaw	141	76	43
Abrasive disk	37	10	1
Hacksaws	86	27	16
Rotary, hot or cold	72	17	21
Other	36	22	4
Drilling Machines	481	93	208
Sensitive	171	19	121
Upright: Single-spindle	232	63	59
Gang	5	1	3
Radial	58	8	23
Multi-spindle cluster, adjustable & fixed center	13	1	1
Unit head and way type, multi-spindle	–	–	–
Deep-hole drills	–	–	–
Other	2	1	1
Gear Cutting and Finishing Machines	78	8	55
Hobbing machines	55	5	46
Shapers, gear	5	2	2
Cutters, form-milling type	8	1	5
Bevel gear cutters (not planer)	–	–	–
Cutters, planer type	1	–	1
Grinders, gear	–	–	–
Shavers, gear	–	–	–
Burnishing and lapping	–	–	–
Chamfering, tooth pointing, tooth rounding	–	–	–
Other	1	–	1
Gear Checking Machines	–	–	–
Grinding Machines	673	170	255
External cylindrical, plain and universal	279	31	176
Internal cylindrical	11	2	4
Centerless: External	4	1	–
Internal	–	–	–
Surface: Rotary table type	16	4	2
Reciprocating type	42	8	12
Disk, horizontal and vertical	10	2	–
Tool and cutter	50	15	13
Bench, floor-stand, and snag	238	96	42
Abrasive belt (not polishing)	5	4	–
Other	18	7	6
Honing and Lapping	7	–	–
Honing	2	–	–
Lapping: External	–	–	–
Internal	5	–	–
Surface	–	–	–
Lathes	952	172	485
Bench and floor, light-duty	513	67	305
Engine, heavy-duty, incl toolrm, mfg, aut form, gap	286	59	141
Turret lathes: Ram type and hand screw	32	11	8
Saddle type	14	1	3
Automatic chucking, horizontal and vertical	9	–	4
Automatic between centers chucking	2	–	1
Automatic screw machines, bar	58	18	11
Gun and shaft boring	–	–	–
Other	38	16	12
Milling Machines	156	27	72
Bench type	56	4	41
Hand	5	1	4
Knee-type, horizontal	52	12	17
Vertical	13	1	1
Automatic and manufacturing	5	1	–
Bed (Lincoln) type, incl automatic rise and fall	2	1	1
Planer type	16	5	6
Die sinkers (except engraving) & duplicators	1	–	–
Other	6	2	2
Planers	125	8	96
Double housing	107	7	85
Openside	15	1	8
Other	3	–	3
Pipe Cutting and Threading Machines	143	26	65
Polishing and Buffing Machines	152	39	30
Speed lathes	27	2	–
Polishing stands	42	11	9
Abrasive belt	16	8	1
Other	67	18	20
Rifle Boring Machines (not deep-hole drills)	–	–	–
Shapers	241	46	134
Horizontal	218	41	126
Vertical, including slotters	13	2	7
Keyseaters	10	3	1
Threading (except pipe)	145	82	50
Tapping	97	43	37
Hobbing and milling	5	3	–
Die type	16	3	8
Grinders, thread	7	–	–
Rolling machines, thread	20	13	5
Other	–	–	–
Other Machine Tools	3	–	–
METAL FORMING MACHINERY	888	220	370
Bending and Forming Machines	99	19	41
Bending rolls, sheet and plate	43	3	32
Bending rolls, bars and shapes	3	2	–
Power bending brakes	14	2	7
Rotary forming machines	12	3	1
Bending machines, pipe and bar	17	5	1
Other	10	4	–
Hydraulic Presses	101	16	40
Vertical, single action	66	9	32
Vertical, double and triple action	15	–	2
Horizontal	20	7	6
Other (including hydro-pneumatic)	–	–	–
Pneumatic Presses (except hydro-pneumatic)	2	–	1
Mechanical Presses, Power Driven:	273	94	94
Inclinable	54	33	7
Vertical, C-frame	3	2	–
Vertical, straight-sided	191	50	85
Dieing machines	3	3	–
Horizontal	2	1	–
Other	20	5	2
Punching and Shearing Machines	168	36	90
Punching machines	63	10	47
Plate and sheet shears	57	16	26
Bar and angle shears	25	9	3
Rotary shears	16	1	10
Other	7	–	4
Forging Machinery (except presses)	138	29	95
Hammers, steam or air	78	5	66
Hammers, gravity drop	16	7	9
Hammers, helve	3	1	2
Forging machines (headers) and rolls	36	12	18
Other	5	4	–
Swaging Machines	80	21	9
Wire and Strip Forming Machines	23	3	–
Die Casting Machines	–	–	–
Hot chamber	–	–	–
Cold chamber	–	–	–
Plastic Molding Machines	–	–	–
Injection	–	–	–
Compression	–	–	–
Riveting Machines (Not Portable)	4	2	–
OTHER SHOP EQUIPMENT	2,648	615	724
Electric Welding Machines (Not Hand)	788	153	299
Arc: Motor-generator set	696	139	299
Transformer	30	2	–
Automatic and other	12	–	–
Resistance: Spot	19	4	–
Projection	–	–	–
Gun	–	–	–
Seam	8	2	–
Butt and flash	23	6	–
Gas Welding, Cutting Machines (Not Hand)	159	101	–
Flame cutting	91	55	–
Welding	68	46	–
Balancing Machines	3	1	–
Air Compressors	119	34	22
Plating Equipment	15	11	1
Machines	7	6	–
Tanks	7	4	1
Barrels	1	1	–
Materials Heating Equipment	278	77	57
Heat-treating furnaces	125	30	23
Stock-heating furnaces	95	38	25
Salt baths	19	4	7
Induction heating units	28	1	–
Baking and drying ovens	7	2	2
Other	4	2	–
Cleaning Equipment	117	18	12
Tumbling barrels	27	4	7
Shot and abrasive blast	10	6	–
Parts washing machines	2	1	–
Pickling machines	11	3	5
Tanks	67	4	–
Cranes, Overhead Traveling	350	65	199
Hoists (Incl. Jib and Rail Mounting)	561	120	90
Chain, hand	212	56	64
Electric	260	35	24
Pneumatic	89	29	2
Industrial Trucks	258	35	44
Lift	209	28	39
Truck-tractor	74	4	3
Powered hand trucks	14	–	1
Crane	11	3	1

How the Inventory Was Taken

Twice as many returns as in the previous Inventory made possible a 38% increase in the detail of data presented. This survey also covers 28% more types of equipment and provides an added age group, plus detailed statistics by 25 marketing areas rather than by the previous nine geographic areas

FROM the beginning, in 1925, the method used to compile the Inventory has remained essentially the same. However, refinements in the methods, based on experience, and improvements in the subsidiary data available, have made for a steady increase in the accuracy of the information obtained.

For the Mid-Century Inventory, more than 50,000 questionnaires were mailed to production plants (not including the special studies of college shops and maintenance shops). The mailing list came from the McGraw-Hill Census of Manufacturers and other sources. This was supplemented by personal calls to many large firms.

Improved Response

The value of this periodic study has become evident through the years, so that the response each time has proved to be better than that for the preceding surveys. Thousands of firms, ranging in size from one employee to more than 100,000 employees each, supplied detailed data on their equipment by age groups. Each return was classified, industrially and geographically, and the data were summarized. The sample thus obtained was expanded to give the total figures published herewith.

The expansion is based upon the assumption that in a given industry division where manufacturing methods are uniform, the ratio of wage earners to machines is constant. Although the data are published for 15 major industries making up metalworking, the statistical work was all done with 44 industry divisions. Breaking it down in this detail insured the greatest possible homogeneity in each division for the maximum practical accuracy.

Basic data on wage earners, used to determine the expansion factors, were taken from the preliminary 1949 McGraw-Hill Census of Manufacturers and the 1947 U.S. Census of Manufacturers. The method can best be explained with an example:

Returns were received from aircraft plants employing 157,454 persons. These returns show a total of 1774 engine lathes.

The 1949 McGraw-Hill Census reports that there are 277,268 employees in aircraft plants employing 21 or more persons. From the 1947 U.S. Census it was determined that there were 0.53% as many employees in plants with less than 20 workers as there were in plants with 20 or more workers. Multiplying the 1949 McGraw-Hill figure, (277,268) by 1.0053, therefore, gave total current employment of 278,737 in the aircraft industry. (Actually, there is a difference of 1 worker in the dividing line of the two censuses, so that plants with 20 workers are not included in this correction. Although 66% of the metalworking plants have less than 20 workers, they employ only 3.95% of the workers, so the effect of this discrepancy is probably less than 0.1%.)

The sample obtained from the aircraft industry, therefore, was 157,454 divided by 278,729, or 56%. The expansion factor was 278,729 divided by 157,454, or 1.77 for engine lathes. As 1774 engine lathes were reported, this number multiplied by 1.77 gave the total number, 3140, which is given in the Inventory.

Essentially this same procedure was followed for every figure reported in the Mid-Century Inventory. Due allowance was made for the fact that not every company was able to report every type of equipment. Thus through a given table, different expansion factors were used in many cases.

(To amplify the previous statement, a plant not reporting boring machines of a certain type naturally would not have any boring machines of that type. The employees of this company would be included in determining the expansion factors for boring machines. However, a number of large concerns gave no data on certain types of equipment, such as hoists—although such equipment is in use in their plants. It was these cases that were excluded in computing expansion factors for such equipment).

Variations

Although the over-all figures are accurate, because of the sampling method which, of necessity, is followed, there is bound to be some variation from actual in the detailed breakdowns. This variation is most likely to be relatively large on those categories where a small number of machines are reported. In the same way, where blank spaces appear in the detailed tables it does not follow that there are no machines. It means that there were none in the sample obtained. There may actually be a few machines, but it is unlikely that there is more than a handful.

The sample in the example cited above was 56%. The samples throughout were much larger than is customary in studies of this type. They range, for the various categories, from 11 to 83%.

NEWS OF METALWORKING

Army Ordnance Tests Titanium For Use on Tanks in Place of Steel

By PAUL LEACH

WASHINGTON — A tank armor roughly half the weight of the present steel plate, and even more resistant to penetration, is in the offing. Army Ordnance is conducting tests now on the new metal titanium, which, it is believed, may eventually replace steel as cladding on tanks.

There are a lot of "ifs" in the work as yet, but scale tests have shown that half-inch titanium plate can do as good or even better a job than the best homogeneous steel alloy plate. And titanium is only 60% as heavy as steel.

It is too early yet to tell just how good the titanium metal is as an armor plating material. Researchers are finding, however, that there are conditions where the new metal is more resistant to penetration than is steel of equal thickness. This is particularly important now that considerable emphasis is being placed on the development of fast, strong, light tanks which can be carried in airplanes. With a saving of four pounds in every ten possible through the substitution of titanium for steel, a 25-ton tank made of the new material could be a whopper, and still be light enough to be air-lifted.

Cost is Prohibiting Factor

Cost ($7.50 a pound for ingot titanium) is still a prohibiting factor in use of the new metal, but industry has been saying that new processes now being worked out will reduce the price materially in the future.

Most of Ordnance's work on the metal is being restricted to basic research, particularly in the creation of equilibrium diagrams of the pure metal in combination with various elements such as carbon, nitrogen, molybdenum, vanadium, columbium, tungsten, and chromium. Columbia University and the California Institute of Technology are doing the diagraming work for the Army.

Early tests with titanium compounds have shown amazing hardness reactions. In titanium-carbon or titanium-nitrogen compounds, for instance, hardnesses of 1500 (Brinnell) or higher have been recorded.

Ordnance is also looking into basic properties of titanium to see if it will work as cladding in guided missiles, also as basic metal in them, because of its resistance to corrosion and its light weight. Replacing steel with it in rockets would give 40% to 50% savings in fuel, with greater range.

Graded ingot work on titanium alloying is being done by a number of people, including Allegheny-Ludlum in Pittsburgh, Bohn Aluminum in Detroit, P. R. Mallory at Indianapolis, DuPont at Remington Arms, Battelle Institute at Columbus, Ohio, Foote Mineral, and others.

The infantry soldier has shown particular interest in two ideas Ordnance is applying, or thinking of applying, to titanium. One is as a replacement for ferrous metal in crew-served weapons, to lighten their weight. The other is in the construction of lightweight body - armor.

Industry's Help Wanted In Work on Titanium

WASHINGTON—One titanium problem which Army Ordnance is particularly anxious to have industry tackle is that of construction methods in use of the material, including arc welding, forming and shaping.

Early experiments have shown that helium-atmosphere and argon-atmosphere shielding of arc welding produced better results than those obtained in welding in normal atmosphere. This is something that Ordnance wants help with.

Anyone interested in working with Ordnance in either welding or forming the new metal should contact Col. Alden P. Taber, Office of the Chief of Ordnance, the Pentagon, Washington 25, D.C.

***SEVEN NEW VEHICLES** have come out of Army Ordnance's Aberdeen Proving Grounds laboratories this year. They're shown here with an eighth vehicle, the M-37, a modern gun carrier adaption of the wartime "Priest" type chassis. The new seven: (1) T-44 cargo carrier towing an 8 in. gun, built by Detroit Arsenal; (2) T-53 three-quarter ton cross-country carrier built by Chrysler Corp., utilizing the new Ordnance air cooled engine; (3) T-30 cross-country cargo carrier, an 8-ton 6x6 made by Kenworth Motor Truck Corp.; (4) T-28 100-ton, low-silhouette tank mounting a 105 mm gun, built at Detroit Arsenal; (5) M-41 gun carrier 43,000 lb, carrying a 155 mm howitzer mounted on a light tank chassis; (6) M-26A-1 truck tractor, built by Pacific Car & Foundry Co., with trailer by Fruehauf, designed for transport of medium tanks; (7) T-26 truck tractor built by Sterling Motors, with T-63 trailer built by Easton Car & Foundry Co.*

• *Economy in Production Stressed by Exhibitors at*

THE METAL SHOW

31st National Metal Congress and Exposition Draws Record Crowd of Executives and Shop Men

CLEVELAND — The "Economy-in-Production" theme was carried out by most of the 362 exhibitors at the 31st National Metal Congress & Exposition in the Public Auditorium here Oct. 17-21. Attendance, estimated at 25% above last year, was a cross-section of metalworking executives and shop men. Almost 300 papers were presented at accompanying sessions of the four sponsoring societies, the American Society for Metals, American Welding Society, Metals Branch A.I.M.E., and the Society for Non-Destructive Testing.

Machines & Processes

In addition to new equipment described in AMERICAN MACHINIST for Oct. 6 and previously, a number of new developments were shown. These are summarized here, to be followed by more detailed descriptions in subsequent issues.

Glenn L. Martin Co. showed sheet-metal parts produced by its new combined hydraulic and mechanical forming process, "Marform." Parts can be formed of common sheet metals without wrinkles or excessive springback to tolerances of ± 0.002 in. at costs lower than those of familiar methods.

A shear attachment for Steelweld press brakes, developed by Cyril Bath Co., is mounted on the back of the machine, between the columns, so shearing can be done when desired. The attachment can be swung out of the way, when not in use, by means of controls mounted on the front of the machine.

A heavy-duty twin-wheel tool grinder developed by Standard Electrical Tool Co. has wheels side by side so their faces are in line. The unit incorporates adjustment for wheel wear, a stationary table tiltable from 15° up to 30° down, and built-in coolant supply and exhaust outlets.

National Diamond Laboratory showed a new low-cost diamond boring bar for cemented carbides; Tomkins-Johnson Co. two improved models of air cylinders. Erickson Steel Company demonstrated a low-price ($215) speed indexer, air or hydraulically operated and positive locking. It has a 1½-in., 8 tpi spindle nose and 24-position indexing plate providing 4, 6, 8, 12 and 24 positions; other plates including up to 50 positions are available.

A 500-ton die caster shown by Kux Machine Co. incorporates a pressure multiplier to double injection pressure at the end of the shot, to form a denser, more-solid casting.

Standard Oil Co. of Ohio has announced Sulkleer 177-X, a dual-purpose cutting oil for screw machines which acts both as a machine lubricant and a high-film-strength coolant. It is a sulfurized oil with the sulfur non-reactive at bearing temperatures but active at cutting temperatures.

Reeves Pulley Co. showed two new items, a hydraulic automatic control for Nos. 4000 to 7000 Motodrives which requires only a few ounces of pressure on the control lever to change output speed, and the Vari-Speed Jr., an inexpensive variable-speed control for light power requirements.

Campbell Division (American Chain & Cable) showed its new Model 15 wet (2500 rpm) or dry (4800 rpm) abrasive cutting machine, a low-cost ($600) unit capable of cutting tube up to 1½-in. dia and solid bar up to ¾-in. dia with a 3-hp motor, or 2 in. and 1 in. respectively with a 5-hp motor. An angular cutting device is built in. Stone Machinery Co. demonstrated a 2380-rpm swing-cut cut-off machine with geared-head motor and a self-centering vise capable of any angle up to 46°. Cuts to tolerances of 0.005 in. can be made.

Wells Mfg. Corp. has a "Feed Master" automatic feed for metal-cutting bandsaws, adjustable for any size or shape of material. It is air operated, portable and can handle multiple cuts to 18 in. The company also introduced Model 49A bandsaw, an inexpensive unit with welded-steel frame and tubular-steel base. It can handle 3½-in. rounds and 3½x6⅝-in. rectangular work, has three speeds (54, 100 and 190 fpm) and uses a 1/6-hp. motor.

Two new machines and two new saw blades were shown by The Do-All Co. A Contour-matic saw has 16-in. stroke, with hydraulic table feed and hydraulic tilting of the T-slotted table. It provides stepless surface speeds of 40 to 10,000 sfpm, and can be equipped with familiar blade types (including filing and polishing) as well as two new blades, one a line-grinding type with "diamond" edge (can be any of the abrasives) actually applied in blocks to spuds on a band blade and fully flexible and a band with tungsten-carbide inserted

Arthur E. Focke
President, ASM

D. B. J. Fraser
President, AWS

L. E. Young
President, AIME

Dana W. Smith
President, SNDT

***THE MAIN ARENA,** one of four exhibit halls at the Cleveland Metal Show*

teeth for cutting tough alloys. A second machine, the angle-head cutoff bandsaw for high-precision and production work, has a horizontal axis for the bandwheels and a horizontal cutting plane like familiar metal-cutting bandsaws, but differs in that the blade is turned 90° for the cutting, with no reduction in blade life. Hydraulic lift and hydraulic variable speed are inbuilt, plus a 3-speed transmission.

Heat Treating

Cincinnati Milling & Grinding Machines, Inc., demonstrated an electronically controlled Flamatic hardening machine tooled for flame hardening serrated gripping faces of eight pipe-wrench jaws at a time. Operation is fully automatic except for loading. Dual stations permit continuous heating cycles, so production averages 1500 pieces per hour.

Gas Appliance Service, Inc., had on review a new Roto-Flame furnace for end-hardening jobs. Single or double rows of burners shoot flames along the refractory arch to sweep around bar stock and tubing. A Zig-Zag burner for local flame heating was also shown.

Hevi Duty Electric Co. demonstrated its new shaker-hearth furnace designed for bright hardening, bright carburizing, dry cyaniding and other like processes. No bearings, hangers or moving conveyor parts inside the heating chamber can cause trouble. Motion of the hearth plate shifts parts through the furnace. The absence of trays, which would have to be heated, reduces the heat requirements.

Baker & Co., Inc., has produced a Nitroneal generator that delivers pure nitrogen with a controllable hydrogen content for furnace atmospheres. Cubic-feet outputs per hour range from 25 to 100,000 in six models. Explosion dangers are eliminated by Englehard catalysts which keep down the hydrogen concentrations.

American Cyanamid Co. presented two heat-treating media—Aeroheat 1190, which is a granular chloride mixture for salt-bath heating; and Aerocarb E and W, both liquid-bath mixtures, in granular and briquetted forms.

Eclipse Fuel Engineering Co. added a Vari-Flame burner, a Consta-Mix proportioning valve, a Lock-Tite safety valve, and Piloted P W Wall-tite burners to its line. The burner is built for billet, forging, and kiln heating, and can be adjusted for flame size without modifying the air-gas mixture. A single adjustment on the proportioning valve controls an air-gas mixture. The valve has a dry spun-glass filter to shut out oil. Safety shut-off valves can cut gas supplies to combustion chambers in case of electrical, air, or gas failures. The PW burners fire pre-mixed gases in tunnels entirely outside furnace walls. Capacities range from 20,000 to 600,000 BTU per hr.

Polishing and Buffing

Displayed for the first time was an all-around liquid buffing compound known as Liquimatic. Produced by J. C. Miller Co., this material is said to effect substantial economies in metal finishing. Special equipment is required for spraying the compound on the wheels, and this can be applied to various types of automatic polishing machines. The material is fast cutting, non setting, has high flash point and long storage life.

Hammond Machinery Builders introduced the "Super" automatic rotary machine for grinding, polishing, buffing and deburring. Through extremely fast indexing, a wide range of work spindle speeds, and a variable dwell time under the wheels, it is claimed that savings over standard automatic machines are as high as 41% in some cases. The machine is available in different models from 3 to 15 hp, has unit construction for easy accessibility, and features automatic composition applicators and air-operated head lifters.

Electric industrial trucks powered with 18-volt instead of previously used 12-volt batteries were shown by the Moto-Truc Co. A floor-operated, counterbalanced fork-lift model is made in five sizes with 2000 and 2500-lb capacities. Another new platform-lift model has 10,000-lb capacity with 26- to 36-in. platform widths and 36- to 72-in. lengths.

Shown by the Detrex Corp. were industrial drycleaning units that are completely automatic in operation and involve no fire hazard. Shop gloves of cotton, canvas, or leather, shop coats, wiping cloths, and other items containing a high oil content are readily handled.

A new model whiteprinting machine was introduced by the Charles Bruning Co. With a variable printing speed up to 24 fpm, the unit is said to produce up to 10,000 sq ft of prints in an ordinary working day.

Recommended by Kennametal Inc. for high-temperature operating conditions were recently-developed Kennametal grades in the K138 class. Essentially titanium carbide, with either cobalt or nickel, depending upon requirements, the new ma-

Induction Heating Units Displayed at Metal Show

Ohio Crankshaft Co. has a new vertical design high-frequency motor-generator set made by Reliance Electric. The unit has heat-exchanger type water cooling, thermal overload protection, is lighter, and takes less floor space. Two sizes are available, a 250-kw at 10,000 cps and a 300-kw at 3000 cps. New heating stations can be located anywhere, are complete in themselves and incorporate all necessary controls so a number can be operated from one power source. All have interlocks to kill power when the door is opened, and only one master station (meters and generator controls) is required regardless of number of outlets.

Lindberg Engrg. Co. has introduced a new line of heavy-duty, vacuum-tube converter induction-heating units with a 10-kw at 450,000 cps size. It incorporates interlocks and the design and construction features of larger units.

terials were said to offer the following advantages: higher strength and resistance to oxidation than cast alloys at 1800F and above; high Young's modulus of elasticity; and greater thermal shock resistance than ceramics. Applications for various grades include resistance heating elements for electric furnaces and hot working dies where severe shock is encountered.

Welding Equipment

Air Reduction Sales Co. announced the Aircomatic process for welding stainless steel and aluminum bronze —an outgrowth of the aluminum welding process developed previously. The inert-gas shield method has the advantage of depositing filler metal in stainless welds without allowing much alloy-element loss. High speeds—up to 15 lb per arc-hr for 1/16-in. wire—are possible, and normal mechanical problems caused by electrodes are not present.

Westinghouse Electric Co. showed a new dc welder that works off dry-disc selenium rectifiers and a 3-phase reactor—sizes for 200, 300, and 400 amps. High power factors and no-load KVA around 9% reduces power drain and cuts no-load losses 15-20% under other same-capacity models.

Miller Electric Manufacturing Co. had Model 202 Heliarc welder on exhibit—with a range from 40 to 300 amps. High-frequency power unit inside the welder is controlled by a single knob. Another product was a portable spotwelder for stainless and mild steels up to ⅛-in. thickness. A toggle-action lever increases the force under hand pressure—and is adjustable for thickness of metal being joined.

General Electric Co. showed an inert-gas flow-control unit for dc welding—similar to a control already installed on some ac equipment. A separate switch can be held by the operator to give up to 40 sec delay after the arc is broken.

Ransome Div. of Worthington Pump and Machinery Corp. produced a large-size turn-roll positioner for tanks and other round units up to 20 ft in diameter and weighing as much as 75 tons.

Harnischfeger Corp. demonstrated a line of low-hydrogen electrodes for alloy steels to replace G S rods formerly used on high-tensile-strength welds.

The Champion Rivet Company's Hy-Lo electrodes range from ⅛ in. to 5/16 in. and carry 140 to 450 amps. Chromoly electrodes produce 80,000 to 130,000 psi welds with hot arcs and good penetration.

Arcos Corp. showed two new electrodes—Mixend 99 for most gray cast iron, and Mixend 60 for cast irons high in phosphorus. Sizes from 3/16 in. to 3/32 in. are carried.

Eutectic Welding Alloys Corp. has a new 25/50 ac-dc electrode for high-strength welding of cast iron.

Heating Units

Among heating units shown was "Platecoil," a heating coil produced by welding together two embossed 16-gage sheets, thus providing channels through which the heating or cooling medium flows. Kold-Hold Mfg. Co. claims this unit weighs half as much as a pipe coil, takes half the space and heats or cools 50% faster.

Instruments

An automatic recorder, the X-Y Speedomax, was demonstrated by Leeds & Northrup Co. By providing motion in two directions in the pen, and the two others in the chart, the unit can be combined with suitable dc circuits to plot hysteresis loops, stress-strain curves and other algebraic test problems. The same company has a new 8890 Rayotube, replacing three earlier models for temperature indicating, and a series of pH electrodes and assemblies made in moisture-proof plastic . . . Wheelco Instruments Co. displayed the Model 1300 Flame-otrol, a protective device for any fuel-fired unit. Also shown for the first time was an indicating resistance thermometer suitable for −300F to + 1000 at single or multiple points . . . Pyrometer Instrument Co. showed a rapid recorder radiation tube usable with any recorder or indicator, and entirely self contained. The same company has a direct-reading, all-purpose, inexpensive surface pyrometer with a variety of thermocouples . . . Partlow Corp. showed a new combustion-gas pilot and main burner for low-temperature ovens. It operates on the flame-conductivity principle and is designed to prevent explosions and fire hazards.

Tinius Olsen Testing Machine Co. showed four new units, low-load ranges (1000 lb reading by 2 lb) for the "L" type hydraulic testing machines, an electronic recorder for strain magnifications from 1000:1, an LC testing machine with dual-capacity ranges of 10,000 and 1000 lb, and the Electrodyne Indicator (Type EAA) which shows amount and location of unbalance in rotors.

North American Philips Co. showed the equipment necessary for laboratory quantitative analysis by X-ray fluorescence. Equipment is still under development for production testing of steel composition, coating thickness and like uses.

Exhibitors Reveal Plating Equipment

In the electroplating field, Udylite Corp. introduced a number of developments, including Lucite cylinders interchangeable with standard Udylite cylinders in use in the field. These are acid and alkali proof and have about 30% greater perforated area than regular cylinders, giving faster plating.

Of interest also was a new container for bright nickel solutions made of stainless steel. It is a low-weight "beer barrel" to replace fragile glass carboys.

Outstanding, however, was a fully hydraulic, return type chainless conveyor plater so designed that a 27-ft machine has the plating capacity of a regular 45-ft machine. Spacing between hangers can be varied and a preliminary "flash" plate applied to insure coverage.

Krause Testing Machine Co. exhibited a magnifying micrometer for measuring the thickness of coatings of paint, enamel or electro-plate on either magnetic or non-magnetic materials. The instrument operates as a comparator against a tapered master.

NMTA Notes Industrial Relations Achievements

CHICAGO — Separation of work measurement from compensation and standardization of timestudy methods were urged by Phil Carroll, industrial engineering consultant, as the answer to many of the problems arising from incentive pay, or piece rates. He spoke before the general conference on collective bargaining of the National Metal Trades Assn. convention held here Oct. 26-28.

A feature of the convention was presentation of NMTA's first annual award for outstanding achievement in industrial relations to Louis Ruthenberg, chairman, Servel, Inc.

Wigglesworth to Hold Machine Tool Show

CAMBRIDGE, Mass.—A large individual dealer showing of the latest types of machine tools will be held Nov. 14-18 at Wigglesworth Machinery Co., 199 Bent St., here. All machines will be in operation and demonstrated by factory representatives. Precision boring machines, many types of toolroom and production turning machines, grinders, drills, and power presses will be displayed. Sound films will be shown of different machines in operation on many types of jobs which will be of interest to many people who have comparable work in their plants, the Cambridge firm said.

Fight on Pricing Legislation Looms

WASHINGTON—An all-out fight on the classic issue of hard competition versus soft competition is foreseen after the first of the year when Congress acts on new delivered pricing legislation.

In October a conference committee agreed on a compromise version of two slightly different House and Senate bills, which the House quickly approved only to have the Senate drop it until Jan. 20.

At that time Senators—as well as businessmen—will split on this question: Should the Robinson-Patman act be amended to let a seller charged with price discrimination go free if he can show that his lower price to one customer, as compared with another, was made to meet the lower price of a competing seller?

Hard competition says: You're darned right. Soft competition says: Sure—but not if the Federal Trade Commission finds that the net effect of this discriminatory price may be to substantially lessen competition.

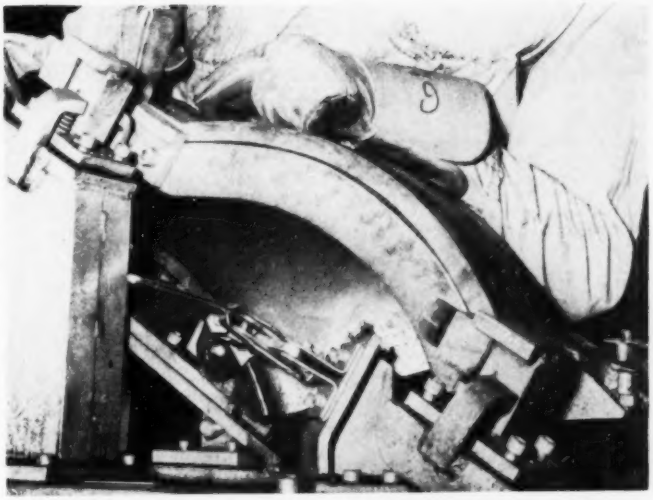
Individual Use is Legalized

Essentially, provisions of the conference committee's compromise legislation boil down to this: Individual use of delivered-price is legalized. Good faith meeting of a competitor's lower price is enough to stop cold a Federal Trade Commission complaint based on price discrimination charges.

If the bill does get through the Senate next year, President Truman may veto it for the small business vote. If he doesn't, or if his veto is over-ridden, it will take years to get enough court decisions to spell out exactly what the bill means for sure.

Differences of understanding have been expressed over that section of the bill dealing with absorption of freight. The bill says it's not discrimination "to absorb freight to meet the equally low price of a competitor in good faith . . ." And here's the important proviso—"(except where such absorption of freight would be such that the effect upon competition will be to substantially lessen competition.)"

A big ruckus broke out over this proviso; specifically, over the difference between "will be" and "may be." The point of the difference: The Supreme Court has several times upheld FTC as a "body of experts" whose job is to block incipient monopoly by issuing cease and desist orders against pricing practices which "may" substantially lessen competition. Under this new version, FTC will have a much tougher task: proving that the effect of any given freight absorption actually "will" lessen competition.



***WELDING CLAMP** for a Heliarc fixture, spring loaded, allows clamp to become a floating part, assuring even welds despite variances in metal thickness. Suggested by Olin Baxley, welder at General Motors' South Gate, Calif., assembly plant, it won for him a $1000 U.S. Savings Bond. Installed at cost of $20 per press, it has already saved 50% in cleanup time. Bolts which formerly held the fixture firm were merely loosened and 4½ in. die springs used to suspend the entire top of the press*

Aluminum Output for Aircraft Not Affected by Steel Strike

PITTSBURGH—Aircraft production won't be hurt by the steel strike—unless it's prolonged. That's the feeling at Aluminum Corporation of America, one of the firms struck by the CIO steel workers, and the nation's largest aluminum producer. Alcoa gives this picture of the aluminum situation in aircraft:

Alcoa's aluminum production is cut 50%. The country's production is cut 25%.

Alcoa has considerable stock of aluminum sheet used in aircraft. Also, the aircraft companies are believed to have maintained substantial inventories of aluminum sheet.

Aircraft manufacturers are well stocked on their standard items. There won't be a pinch for several weeks, and then only in some items. It will be several weeks, too, before the new Air Forces appropriation is translated into orders for more aluminum.

Extrusions for airframe are produced mostly at Alcoa's plant at Lafayette, Ind., and that is not struck because the steel union is not in that plant. Besides, this plant has more capacity than it has been utilizing, so that it could produce more.

Also not struck are the Cleveland and Verona (Calif.) plants where most of the forgings and castings used in aircraft are made. The Garwood, N. J., plant, where die castings used in aircraft are made, also is not struck.

The two major mills producing aluminum sheet are struck—New Kensington, Pa., and Alcoa, Tenn.—but Alcoa has a brand new, modern sheet plant at Davenport, Ia., that never has been run at full capacity because of not enough orders.

Alcoa has large amounts of aluminum ingots stocked.

If Alcoa can't satisfy demand, contractors can turn to its competitors, Kaiser and Reynolds.

Century of Progress Recorded

CAMBRIDGE, Mass.—Leading industrialists of New England, customers of Austin-Hastings Co., Inc., will soon receive copies of a 40-page book, "A Century of Progress," giving an account of the company's development since its founding in 1849. The book traces major events through the years, and devotes ample space to present activities. It is illustrated with photographs of personnel, and lists the exclusive lines of tubing, sheet metal, tool steel, machine tools, metalworking and welding equipment for which Austin-Hastings is distributor in New England.

Detroit

STRIKE MAY DELAY NEW MODELS . . . K-F GETS $34-MILLION LOAN

MUNCIE GEAR PLACES TOOLING FOR NEW AUTOMATIC TRANSMISSION

If the great steel strike is still going on when you read these words, it will be a matter of mere days before much of the automobile industry is closed down tight. As the second half of October went forward, plants were beginning to drop out of the operating list one by one, and inventory shortages were cropping up more and more.

Packard was the first to report an effect, going down to three-day-a-week schedules. Then Willys-Overland closed for a week. The first major producer to become involved was the GMC Truck and Coach division, at Pontiac, which reduced to four-day schedules.

Some other General Motors plants were to operate on a four-day basis beginning in November. The hope at GM was that most assembly points could continue to run through much of this month at reduced rate.

One of the biggest worries created by the steel strike in October was that it would delay new model announcements. Practically all buys for 1949 model runs were completed before the walkout occurred; much of the materials and parts required had been produced, if not shipped. Consequently, there is no economical way to shear off the ends of the 1949 model runs if producers so desired.

They must, instead, wait till the flow of steel begins again, and then complete their schedules. That, of course, brings on an attendant delay in getting into production on 1950's. The last days of October and the early days of November are the critical ones in this respect; a last minute settlement would still not impede the progression from '49 to '50 cars.

But even if the strike is terminated immediately, Ford, for one, cannot supply dealers with new cars by scheduled announcement because numerous varieties of steel will not be obtainable in time.

Not the least of the car worries is the fact that national advertising was released on a few new models back before the strike began. Some, with nine and ten week closing dates, could be pulled out; some could not. The companies' worry: That announcements of new models might come out before they have built any.

Borg-Warner Transmission for Ford

Despite the cloudy horizon ahead, much "business as usual" is evident. Announcements of new things and new plans come forward in the pre-strike manner. Most notable of these was the Ford announcement of a deal with Borg-Warner Corp. for a new automatic transmission, to go onto Ford and Mercury cars starting sometime next summer.

The new transmission is of the torque converter type with planetary transmission. Power transmits through the converter, and the device automatically shifts from intermediate speed to high at speeds ranging from 15 mph upward, depending on accelerator pressure. A low gear is used only for tough going. The rear axle ratio in top gear provides operating economies somewhat better than normal installations.

The price on the new job will range somewhat under $150, putting it in line with the anticipated price on the Chevrolet Torqmatic device, which is scheduled for introduction sometime during the winter. The Lincoln division of Ford will continue to use the Hydra-Matic; indications are that Borg-Warner is working hard trying to set up a senior model for the big Ford line.

Tooling is now being placed by the Muncie Gear Division of B-W for the Ford transmission. Estimates are that several million dollars in equipment will be required, a large share of it in special machinery.

K-F Plans Smaller Car Line

Equipment makers are also wending their way these days to Willow Run, where Kaiser-Frazer Corp. has a $34-million jackpot—a loan from the RFC—for tooling a new smaller car line and broadening the other lines. This program will go forward as rapidly as possible. Competitors are somewhat perplexed at what will come out of this planning. They confess they would have a hard time doing all that K-F is planning to do with even that large sum of money.

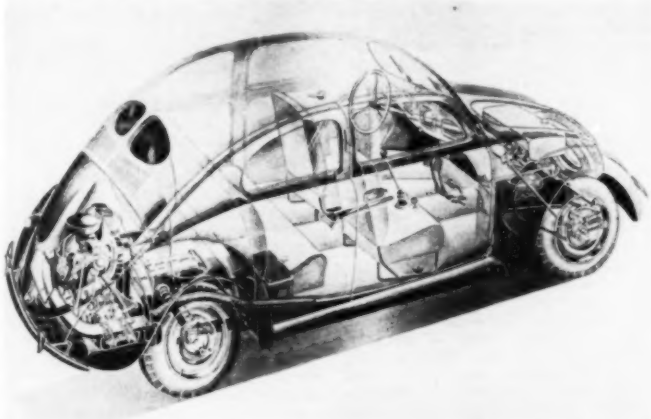
This producer has begun construction on the first unit of its small plant decentralization. This first unit will be erected at Portland, Ore., and will turn out 20 cars a day with a 100 man workforce.

The K-F plan calls for the eventual construction of a series of small assembly units scattered around the country close to retail outlets. Component production parts, including primed bodies shipped 16 to a railroad car, will be received disassembled from the Willow Run plant. All enameling and trimming will be done at Portland.

Watch for New Packard Policies

At Packard there is interest in the policies that will follow installation of a new president—probably executive vice-president Hugh J. Ferry—next Dec. 31. The new man will succeed George T. Christopher, who is retiring at the end of the year.

Christopher's resignation was the subject of gossip in Detroit, but it was a legitimate retirement—he had planned to do so. What most gossipers did not know, however, was that Christopher had intended to retire somewhat later; the timing indicates that he and the conservative Packard board had not seen eye to eye on one thing or another.



***THE VOLKSWAGEN,** Germany's small automobile, is now coming off the assembly line in appreciable quantity. This is the car that Hitler promised for every German family, but World War II interfered with production* *Authenticated News*

Names in the News

C. K. Banks

C. K. Banks has been named director of research of Metal & Thermit Corp., New York. He will make his headquarters at the company's research laboratory at Woodbridge, N. J.

Francis J. Sehn has been named sales engineer at the Detroit office of Clearing Machine Corp., Chicago. He was previously chief die engineer for the Fisher Body tank division.

William C. Howard, Jr., and **Walter E. Foreman** have been appointed field engineers by the Norton Co., Worcester, Mass. Mr. Howard will work out of Hartford, Mr. Foreman out of Cleveland.

W. J. Scott, manager of manufacturing plants, has been named general manufacturing manager, Chevrolet Motor division, General Motors Corp., Detroit. **E. S. Wellock,** manager of assembly plants, succeeds Mr. Scott as manager of manufacturing plants, and **R. G. Ford,** general purchasing agent, succeeds Mr. Wellock as manager of assembly plants. In his new post, Mr. Scott succeeds **Hugh Dean,** named General Motors vice president in charge of the manufacturing staff.

W. C. Rowland has been named manager of the manufacturing and repair division of Westinghouse Electric Corp., Pittsburgh. The Westinghouse Order of Merit—highest honor bestowed by the company upon its employees—was awarded Mr. Rowland in 1948. Other appointments: **Tomlinson Fort,** manager, apparatus sales dept.; **William W. Sproul,** sales manager, industrial products; **Royal C. Bergvall,** engineering manager, industrial products; **Henry N. Muller, Jr.,** and **J. C. Fink,** assistants to the vice president in charge of engineering; **R. S. Kersh,** manager of central station sales; **F. D. Weatherholt,** manager of industrial sales; **G. L. MacLane, Jr.,** manager of the engineering laboratories; **Hendley Blackmon,** assistant manager of engineering association activities.

Emerson D. Ogle has been named manager of the industrial sales dept. of SKF Industries, Inc., Philadelphia.

Harry K. Collins has been named head of the laminated and insulating products division, a new operating unit of the General Electric Co.'s Chemical Dept., Pittsfield, Mass. Headquarters of the new division will be in Coshocton, Ohio. Mr. Collins, who has been manager of the plastics division, is succeeded in that position by **Herbert B. Brusman,** formerly manager of the employee relations division. Mr. Brusman's successor in the latter capacity is **Arthur C. Treece,** former manager of the plastics plants at Pittsfield and Coshocton and most recently assistant to the plastics division manager. Staff announced by Mr. Collins for the new division: **Dr. J. J. Pyle,** engineering manager; **A. B. Wellborn,** manufacturing manager; **E. G. Gray,** sales manager, and **J. A. Beals,** accountant.

Philip B. Niles

Richard H. Diesel

Philip B. Niles has been elected a vice president of Yale & Towne Mfg. Co., and will devote his attention to marketing and to development of executive personnel throughout the company. He has been public relations director for Owens Illinois Glass Co., Toledo, and previously was vice president of American Water Works Co. **Richard H. Diesel** has been named production manager and **Frank S. Haniewich,** assistant production manager, of the Stamford division of Yale & Towne. Prior to his new appointment, Mr. Diesel was director of systems and procedures. Mr. Haniewich joined Yale & Towne in May of this year, after 12 years with Weatherhead Co., Cleveland.

W. J. Scott

R. G. Ford

E. S. Wellock

Bertram Miller

Named Erie Works manager, General Electric Co., as noted in A.M. Oct. 20, page 117

H. L. R. Emmet

Retired after 21 years as Erie Works manager, General Electric Co. Noted in A.M. Oct. 20, page 117

Francis R. O'Leary has been named general manager and **George W. Brady** has been appointed director of engineering of the propeller division of Curtiss-Wright Corp., New York. The appointments follow the recent naming of **Theodore B. Focke** as vice president and general manager of Wright Aeronautical Corp. and of **H. Fletcher Brown** as head of the airplane division at Columbus, Ohio.

Robert W. Breckenridge, vice president of Automatic Die & Products Co., Cleveland, has been elected president and treasurer. **Frank A. Brandes** has been elected board chairman. **Harry W. Breckenridge,** formerly treasurer, has been named vice president. **George B. Gymer,** plant accountant, has been named secretary and assistant treasurer. **Frank M. Joy, Jr.,** has been appointed sales representative. **Carl Koeppe** was named superintendent, and **Theodore Thomas,** purchasing agent.

W. T. Richardson, formerly with Bethlehem Supply Co., Corsicana, Texas, has joined Texas Engineering & Mfg. Co., Inc., Dallas, to head up the Temco tool design dept. Previous to the Bethlehem connection, he was with Dallas Engineering Co. and Rowe Tool & Die Co., Dallas; Toolthrift Co., Pittsburgh, and Mountjoy Machine Co., Houston. He succeeds **Harold W. Hickey,** who has returned to the Temco engineering dept. to assist on the T-35 Military Trainer program.

John A. Broden has been named works manager of the Columbus plant of the Ternstedt division, General Motors Corp., Detroit. He was named director of industrial relations of the Ternstedt-Detroit operation in 1942, and in 1945 was named general production superintendent of the Columbus plant.

Raymond A. Cole has resigned as vice president of Pope Machinery Co., Haverhill, Mass.

J. J. Collins has been named general manager of Iron & Steel Products, Inc., Chicago.

Obituaries

George Robert York, 37, Illinois salesman for The Bullard Co., Bridgeport, Conn., died Sept. 25, after a short illness. He joined Bullard in 1937 as a boring mill operator, after employment as a machine operator with Heppenstall Co., Bridgeport. In 1942 Mr. York was transferred to the Bullard Chicago office as sales engineer.

Frank R. Bacon, 77, board chairman of Cutler-Hammer, Inc., Milwaukee, died Oct. 6.

George D. Keller, 56, president of Keller Motor Corp., Huntsville, Ala., died Oct. 5. He had been with Studebaker Corp. for several years, as sales manager and then, in 1935, as vice president in charge of sales.

Edward R. Fitzgerald, 49, assistant engineer of the refrigeration unit, at the Erie Works of General Electric Co., Erie, Pa., died Oct. 5.

John D. Halen, 60, president and treasurer of General Tool & Die Co., Cleveland, died Oct. 9.

C. Howard Henderson, 53, former administrative executive in quality control of Curtiss-Wright Corp., Buffalo, died Oct. 7.

Raymond H. Martin, 55, plant and sales manager, Bassick-Sack division of Bassick Co., Bridgeport, Conn., died Sept. 21.

Business Items

Lodge & Shipley Co., Cincinnati, has discontinued manufacture of the Acme line of turret lathes in order to devote facilities to the continual development of its extended line of new model "X" and Duomatic lathes. The company will continue to furnish repair parts and most turret lathe tooling for the Acme turret lathe built by the former Acme Machine Tool Co. and by Lodge & Shipley.

Lima-Hamilton Corp., Lima, Ohio, has closed the Lima division's iron foundry and moved operations to Hamilton, for reasons of economy.

Morse Twist Drill & Machine Co., New Bedford, Mass., has opened a large modern warehouse at 447 West Congress St., Detroit, to expedite service and delivery to users of Morse cutting tools in that area.

Fostoria Screw Co., Fostoria, Ohio, has been sold by Bowser, Inc., Chicago, to Plant Purchasing & Equipment Co., Cincinnati. The sale includes two plants and all equipment. Plans call for continuation of the production of gears and other automotive parts.

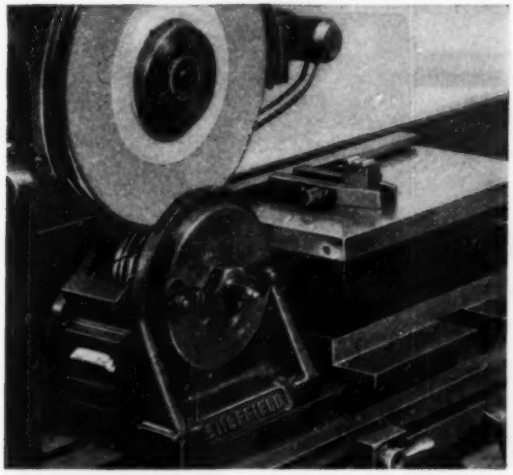
American Machine & Foundry Co., New York, has acquired Union Machinery Co., Joliet, Ill.

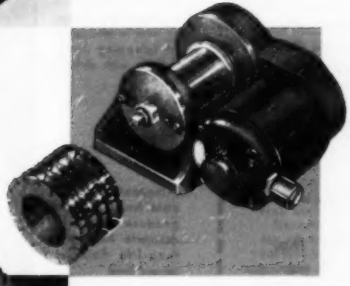
Defiance Machine Works, Inc., Toledo, has sold its plastic preform press business to Baldwin Locomotive Works, Philadelphia. Baldwin will manufacture the preform presses under the Baldwin-Defiance name at the Eddystone plant. Sale by Defiance follows a recent auction of its plant equipment and is a further step in liquidation of the 99-year-old concern. Disposal of steel inventories, a drillpress line and real estate is necessary for completion of the liquidation program.

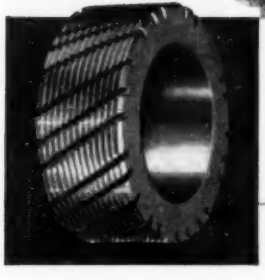
Cincinnati Electrical Tool Co. has acquired Hisey-Wolf Machine Co., Cincinnati. Production of the Hisey-Wolf line of industrial grinding machines and buffing and polishing lathes will continue under the old trade name, in the modern plant of the new owners.

Cincinnati Lathe & Tool Co., subsidiary of Cincinnati Milling Machine Co., has acquired the line of light upright, sensitive and radial drilling machines formerly produced by Canedy-Otto Mfg. Co., Chicago Heights,, Ill. All operations, engineering, manufacturing and sales will be transferred to Cincinnati and production will be resumed soon. The drilling equipment line complements the line of medium duty and light duty engine lathes produced and marketed by Cincinnati Lathe & Tool Co.

Cut Grinding Time up to 75%







and
Reduce the Cost
of Dressing Tools at the Same Time

If you are producing threaded or formed parts, flat or cylindrical, you can make significant savings in both time and over-all costs by the use of Sheffield Crushtrue Devices on commercial surface and cylindrical grinders.

A Crushtrue Roll forms the face of the grinding wheel accurately regardless of how intricate the form may be. Work parts are then ground with this wheel in much less time than is possible by any other method of wheel forming.

Sheffield maintains a stock of Crushtrue Rolls for immediate delivery on all standard U. S. threads from 8 to 32 pitch. When your Std. U. S. Thread Rolls need regrinding, ship them to Sheffield and reground rolls from Sheffield's "Bank" will be shipped to you within 24 hours. You don't have to wait for your original rolls to be reground.

As long as you continue returning your Sheffield standard thread Crushtrue Rolls for regrinding, you will get immediate replacements on an economical cost basis. You will never have to buy new rolls.

The Sheffield "Bank" plan reduces your costs and down time if you manufacture threaded production parts, thread rolling dies or 60° serrated tools. Sheffield Crushtrue Rolls are the answer to greater economy and more productivity.

Crushtrue Rolls for special threads and forms can be supplied economically and promptly.

Write for information or for a personal conference.

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the *Sheffield* corporation

Dayton 1, Ohio, U.S.A.

MASTER CRAFTSMEN SHEFFIELD PRECISION

HERE'S A NEW WAY TO PRODUCE ACCURATE HOLES

Universal joint eliminates need for alignment between power unit and hole.

Honing pressure adjustment regulates stone cutting pressure for different metals, ceramics, glass, etc.

Feed-up control expands honing stone.

THE NEW SUNNEN PORTABLE HONING HEAD

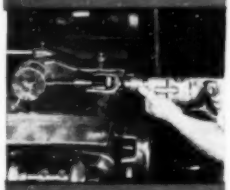
Fills needs in every shop!

- *Production*
- *Tool and Die*
- *Machine Shops*
- *Maintenance*
- *Experimental*

Here's a new tool that will prove to be one of the best time and money savers you ever used! Take it right to the job — use with electric or air drill, lathe or drill press — hone straight, round holes with guaranteed accuracy of one ten-thousandth and surface finish as fine as 2 micro-inches R.M.S.

With Sunnen self-centering honing heads you can remove large amounts of stock — or only that "last ten-thousandth," with assurance of perfect fits every time. You'll find them just right for honing dowel pin, leader pin and ejector pin holes ... extrusion dies, guide pin and drill jig bushings ... for sizing and finishing during machinery assembly ... for production, salvage, maintenance and repair work.

Nine heads accommodate Standard Sunnen honing mandrels covering a diameter range of .120" to 1". Each head is low in cost and in operation—*often pays for itself on the first job!* Let us show you the many different jobs these cost-cutting tools are handling for others. The coupon will bring you full details.



Ideal for machine maintenance. Here the operator is re-sizing holes in a screw machine turret.

Removing distortion from valve housing of hydraulic speed control. Sunnen Honing is 10 times faster than former method (lapping).

Honing bushings after assembly in housing of large hydraulic pipe threading machine. Removes distortion for a perfect free running fit. Honing tool is also ideal for salvaging large castings with defective holes.

In the tool room, portable honing heads produce extremely accurate holes with long-life finish, in record time.

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Please send me (without obligation) full details of the new Sunnen Portable Honing Heads.

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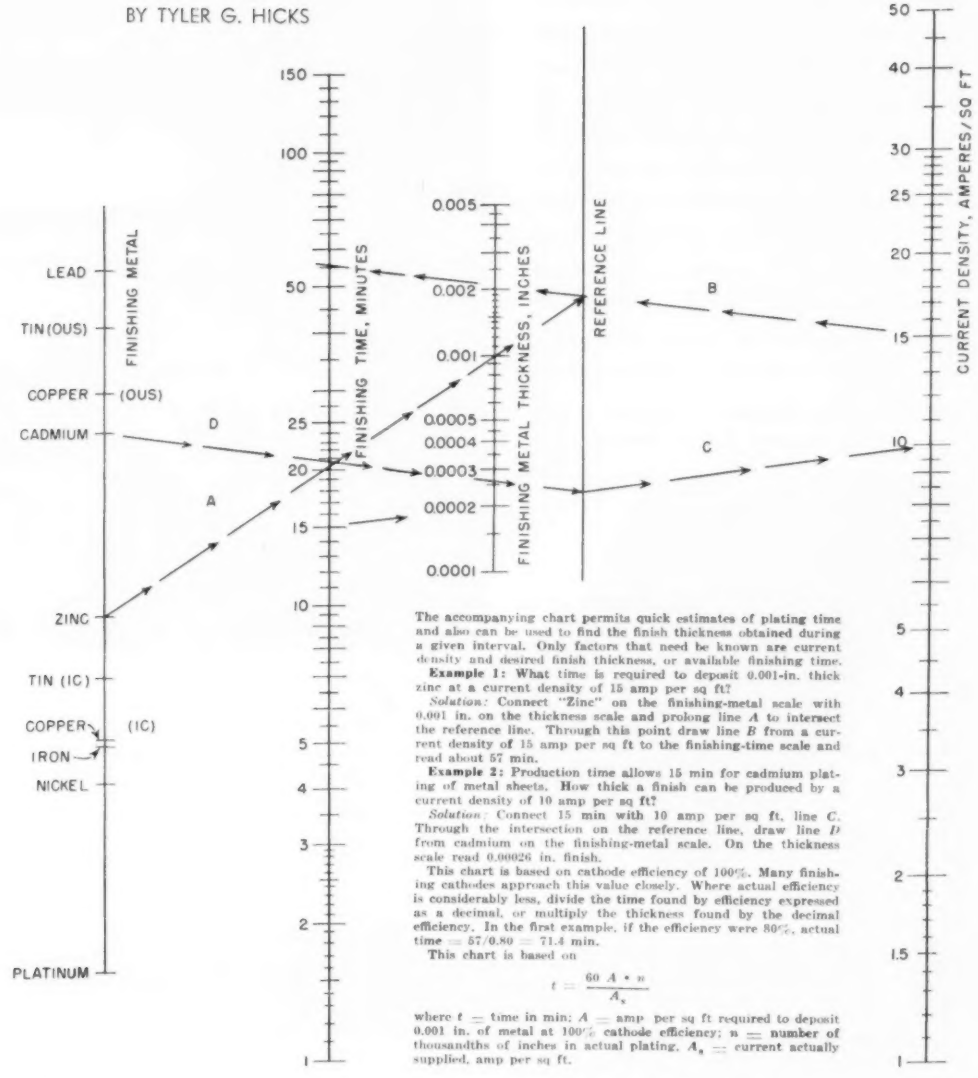
SUNNEN HONING
"Low-cost production of precision holes"

478

Estimating Plating Time

BY TYLER G. HICKS



The accompanying chart permits quick estimates of plating time and also can be used to find the finish thickness obtained during a given interval. Only factors that need be known are current density and desired finish thickness, or available finishing time.

Example 1: What time is required to deposit 0.001-in. thick zinc at a current density of 15 amp per sq ft?

Solution: Connect "Zinc" on the finishing-metal scale with 0.001 in. on the thickness scale and prolong line *A* to intersect the reference line. Through this point draw line *B* from a current density of 15 amp per sq ft to the finishing-time scale and read about 57 min.

Example 2: Production time allows 15 min for cadmium plating of metal sheets. How thick a finish can be produced by a current density of 10 amp per sq ft?

Solution: Connect 15 min with 10 amp per sq ft, line *C*. Through the intersection on the reference line, draw line *D* from cadmium on the finishing-metal scale. On the thickness scale read 0.00026 in. finish.

This chart is based on cathode efficiency of 100%. Many finishing cathodes approach this value closely. Where actual efficiency is considerably less, divide the time found by efficiency expressed as a decimal, or multiply the thickness found by the decimal efficiency. In the first example, if the efficiency were 80%, actual time = 57/0.80 = 71.4 min.

This chart is based on

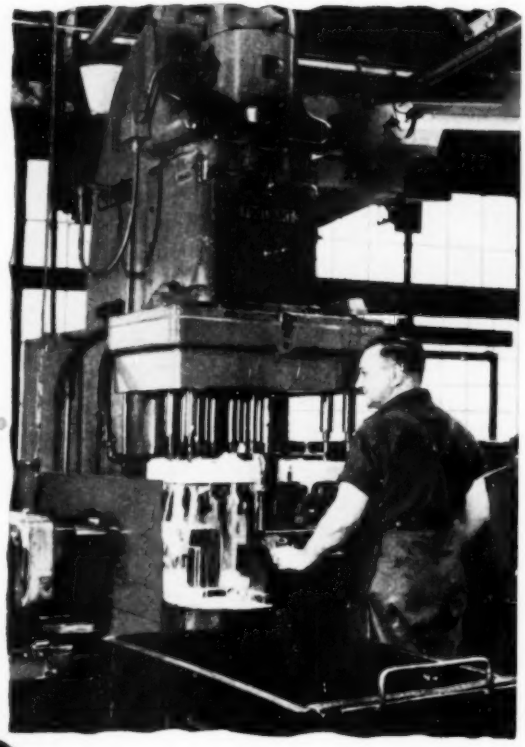
$$t = \frac{60 \; A \cdot n}{A_s}$$

where t = time in min; A = amp per sq ft required to deposit 0.001 in. of metal at 100% cathode efficiency; n = number of thousandths of inches in actual plating, A_s = current actually supplied, amp per sq ft.

FOOTBURT *way drills* . . . .

● Drilling, boring, reaming, countersinking, tapping and all similar machining operations in one, two or more sides of a metal part at one time is standard practice with Footburt Way Drills. It is a method being used in the most productive plants everywhere and in many cases is the only way to reduce today's high cost of manufacturing. Standardized mechanical or hydraulic feeding units combined with "tailor-made" tooling provides the most productive equipment possible at a reasonable price. If you have a production machining problem send blue prints and hourly rate required. We will be glad to make our recommendations.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building



10-A Multiple spindle way type machine with indexing table used for several operations from two directions.

A TIME TESTED LINE OF MACHINE TOOLS

FOOTBURT MACHINE TOOLS

ENGINEERED FOR PRODUCTION

Punch and Die Sets...I

A proposed American Standard published by the American Society of Mechanical Engineers

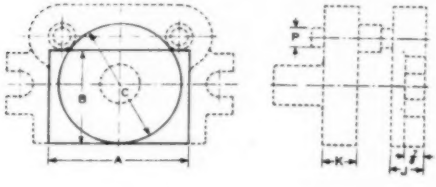
This proposed standard, which has been under development for a number of years, is sponsored by the ASME in conjunction with the Society of Automotive Engineers, the Metal Cutting Tool Institute and the National Machine Tool Builders' Association.

Two series of punch and die sets are covered, back-post sets and diagonal-post sets. They are of conventional type with pressed-in guideposts and guidepost bushings. Standardized die areas may also apply to die sets having patented mountings for the guideposts and guidepost bushings. Types and range of sizes will meet the largest volume of present needs. Tolerances have been established to insure high-grade tools that can be maintained commercially in respect to components and assembly.

Tolerances for Die Sets

	6 x 6 AND UNDER	6 x 6 TO 12 x 12	12 x 12 TO 20 x 20	OVER 20 x 20
DIE HOLDERS				
Parallelism—top and bottom	0.001"/ft	0.001"/ft	0.001"/ft	0.0015"/ft
Thickness	+1/64 −1/32	+1/64 −1/32	+1/32 −1/16	+1/32 −1/16
PUNCH HOLDERS WITH SOLID SHANKS				
Parallelism	0.0015"/ft	0.0015"/ft	0.0015"/ft	— — —
Thickness	± 1/32 in	± 1/32 in	+3/16 −1/16	— — —
PUNCH HOLDERS WITHOUT SHANKS				
Parallelism	0.001"/ft	0.0015"/ft	0.0015"/ft	0.002"/ft
Thickness	± 1/32	± 1/32	± 1/16	± 1/16

Tolerance for parallelism applies to die space or contact surfaces.



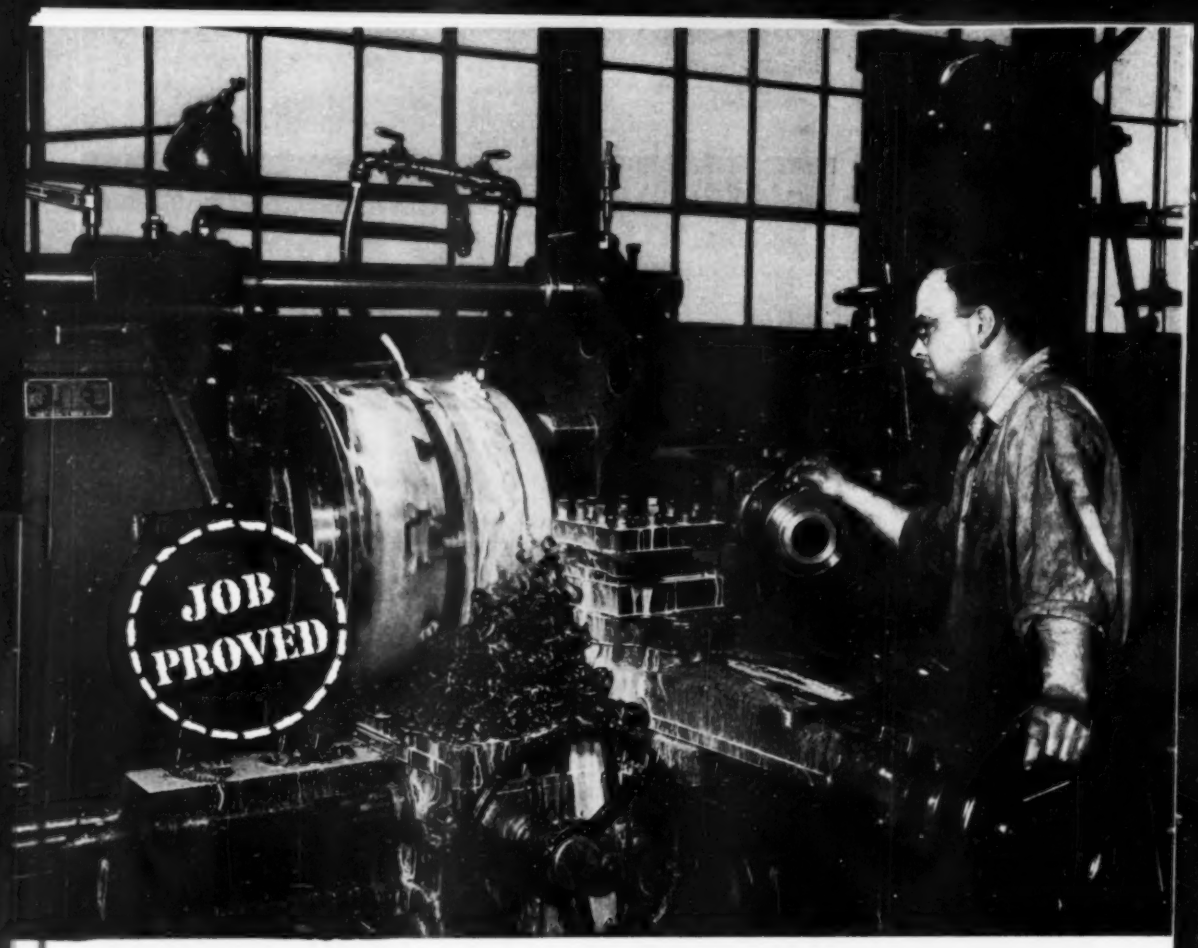
Dimensions of Back-Post Die Sets

Die Area			Thickness				Min Guidepost Diam
			Die Holder		Punch Holder		
			J		K		
Right to Left	Front to Back	Diameter	From	To	From	To	
A	B	C					P
3	3	3	1	1 1/4	1	..	3/4
4	4	4	1 3/8	1 3/4	1 1/4	..	1
4	6	...	1 1/2	2 3/4	1 1/4	2 1/4	1
5	4	...	1 3/8	1 3/4	1 1/4	..	1
5	5	5	1 1/2	2	1 1/4	1 3/4	1
5	8	...	1 1/2	3	1 1/4	2 1/4	1
6	3	...	1 1/2	2	1 1/4	1 3/4	1
6	4	5	1 1/2	2 3/4	1 1/4	2 1/4	1
6	6	6 1/2	1 1/2	2 1/2	1 1/4	2 1/4	1
6	9	...	1 1/2	3 1/4	1 1/4	2 1/4	1 1/4
7	5	5 3/4	1 1/2	3	1 1/4	2 1/4	1
7	7	7 1/2	1 1/2	2 1/2	1 1/4	2 1/4	1
7	10	...	1 5/8	3 1/4	1 3/8	2 1/4	1 1/4
8	4	...	1 1/2	2 1/2	1 1/4	2 1/4	1
8	6	7	1 1/2	3	1 1/4	2 1/4	1
8	8	8 1/2	1 1/2	2 1/2	1 1/4	2 1/4	1
9	12	...	1 3/4	3 1/2	1 1/2	2 1/4	1 1/2
10	5	...	1 1/2	2 1/2	1 1/4	1 3/4	1 1/4
10	7	...	1 3/8	2 3/4	1 3/8	2 1/4	1 1/4
10	10	10	1 5/8	2 3/4	1 3/8	2 1/4	1 1/4
10	14	...	1 7/8	3 3/4	1 5/8	2 3/4	1 1/2
11	9	10	1 3/4	3 1/2	1 1/2	2 1/4	1 3/4
12	4	...	1 3/4	2 1/4	1 1/2	2	1 1/4
12	6	...	1 1/2	2 1/2	1 1/2	2	1 1/4
12	12	12 1/2	1 3/4	3 1/2	1 3/4	2 1/4	1 1/2
12	16	...	2	3 3/4	1 3/4	2 3/4	1 1/2
14	8	...	1 3/4	3 1/4	1 5/8	2 3/4	1 1/2
14	10	11 1/4	1 3/4	3 1/4	1 5/8	2 3/4	1 1/2
14	14	14	1 3/4	3 1/4	1 5/8	2 1/4	1 1/2
15	5	...	1 1/2	2 1/2	1 1/2	2	1 1/2
15	9	...	1 1/2	2 1/2	1 1/2	2	1 1/2
18	8	...	1 1/2	2 1/2	1 1/2	2	1 1/2
18	10	...	1 1/2	2 1/2	1 1/2	2 1/4	1 1/2
18	14	15	2	3	1 3/4	2 1/4	1 1/2
18	16	17	2	3	1 3/4	2 1/4	1 1/2
20	5	...	1 3/4	2 1/2	1 1/2	2	1 1/2
22	6	...	1 3/4	2 1/2	1 1/2	2 1/4	1 1/2
22	12	...	2	3	1 1/2	2	1 1/2
25	7	...	1 3/4	3	1 1/2	2 1/4	1 1/2
25	14	...	1 3/4	3	1 1/2	2 1/4	1 1/2

All dimensions are given in inches.

MATERIAL: This standard does not specify the material for the punch holder or die holder. They are generally made from cast iron, semi-steel, or steel plate and should be free from dirt, slag, and detrimental blow holes and be sufficiently thick to permit machining of outer scale to provide uniform structure as to the finish of the surface on which the punches and dies are mounted. The material should be of sufficient hardness to stand up on service and have good machining qualities.

NOTE: A and B dimensions may be plus or minus 1/2 in. during a five-year transition period, so that suppliers may use present patterns.



S.E.C.O. BEATS COSTLIER CUTTING OIL

Competitive Product Fails to Match Fine Record of Sunoco Emulsifying Cutting Oil in Cost or Performance

For 27 years a metalworking shop used Sunoco Emulsifying Cutting Oil with complete satisfaction on difficult operations. The following is a typical example:

Machine: Gisholt turret lathe, model 4L.
Part: 20" press mold shell 22⅛" O.D. x 6" wide x 20½" I.D.
Operation: Turning, boring rough forgings.
Material: 40-50 carbon steel.
Tools: Firthite carbide tools.
Feed: .012 at 31 rpm.
Cut: ½" to ¾" on O.D. and boring.

Tool life was excellent. Machines stayed clean. High production, with minimum scrap, was the rule year in and year out.

Two years ago the shop was persuaded to try a competitive oil on the above operation. Test results showed that the competitive oil, costing three times as much, lacked stability. Performance was far inferior to that of Sunoco Emulsifying Cutting Oil in regard to tool life and quality of finish. The company was quickly convinced that its original choice had been sound.

In all machine shop operations, on both ferrous and nonferrous metals, you'll find Sunoco Emulsifying Cutting Oil and Sunicut* straight cutting oils of real assistance. They help maintain production schedules, lengthen tool life, and keep operating costs down. For a free Sun cutting oil recommendation card, write Dept. AM-11.

*Sunicut is a trademark of Sun Oil Company

SUN OIL COMPANY · *Philadelphia 3, Pa.*
In Canada: Sun Oil Company, Ltd.
Toronto and Montreal

SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

SUNOCO®

Punch and Die Sets...II

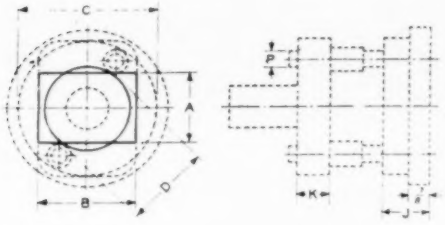
Shank Diameters and Lengths

(Back-Post Die Sets)

Diameter	1 1/2	1 9/16*	2	2 1/2	3
Length	2 1/8	2 1/8	2 7/8	2 7/8	2 7/8

All dimensions are given in inches.

Allowable tolerance on diameter shall be +0.000, −0.002 in.
Allowable tolerance on length shall be ±0.010 in.
Lengths shown are standard but shorter shanks will be furnished when specified.
Steel shanks screwed in place (to be locked by user) will be furnished instead of integrally cast shanks when specified. For threading and detail dimensions see Table 6.
Back-post die sets may be obtained without the shank.
* Not a preferred shank diameter.



Dimensions of Round Diagonal-Post Die Sets

Die Area			Die Holder Dia.	Thickness		Minimum Guidepost Diameter
Rectangular Area		Diameter		Die Holder	Punch Holder	
A	B	D	C	J	K	P
1 3/4	3 1/2	2 3/4	5	1 3/4	1 1/4	1/2
2 1/4	4 1/2	3 1/2	6	1 3/4	1 1/4	5/8
2 3/4	5 1/2	4	7	2	1 1/2	3/4
3 1/2	7	5 1/4	9	2	1 1/2	1
4 1/2	9	7	11	2	1 1/2	1 1/8

All dimensions are given in inches.
Back-post die set tolerances apply.
Material: Same as for back-post die sets.

Shank Diameter and Lengths

(Round Diagonal-Post Die Sets)

Diameter	1 1/2	1 9/16*	2
Length	2 1/8	2 1/8	2 7/8

All dimensions are given in inches.

Allowable tolerance on diameter shall be +0.000, −0.002 in.
Allowable tolerance on length shall be ±0.010 in.
Lengths shown are standard but shorter shanks will furnished when specified.
* Not a preferred shank diameter.

Punch or die holders:

Flange thickness: not machined on top, ± 1/16 in.; machined, + 1/64 or − 1/32 in.

Partial Assembly:

Guideposts, with punch holder removed, must be parallel and at right angles to bottom surface of die holder within 0.001 in. in 6 in.

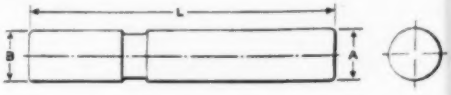
Guide bushings must be parallel and at right angles to top surface of punch holder within 0.001 in. in 6 in.

Differences in center distances of guideposts and guide bushings shall not exceed 0.002 in. on any set.

Shank diameter tolerance, + 0.000 or − 0.002 in.

Assembled Sets

Parallelism of top surface of punch holder and bottom surface of die holder shall be: 6 x 6 and under—0.002 in. per ft; 6 x 6 to 12 x 12—0.0025 in. per ft; 12 x 2 to 20 x 20—0.0025 in. per ft, and over 20 x 20—0.003 in. per ft.



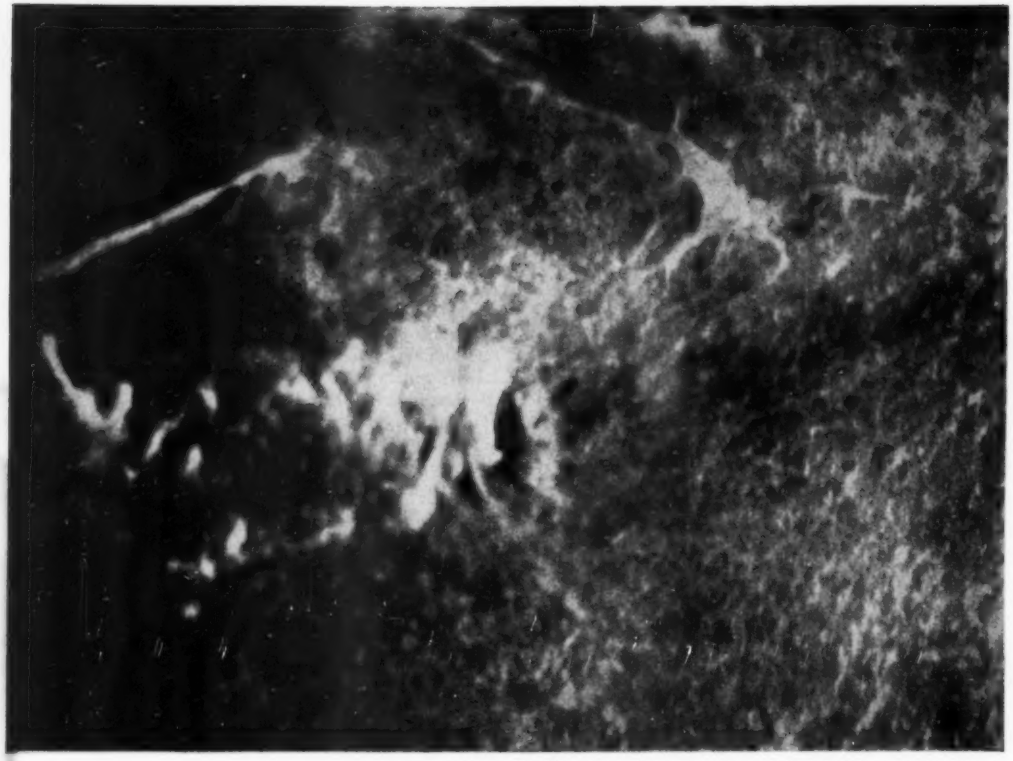
Dimensions of Guideposts—Regular Series

Nominal Diameter	Diameter				Length	
	Ground		Lapped			
	B		A		L	
	Max	Min	Max	Min	From	To
1/2	0.5017	0.5012	0.5002	0.5000	4	4 1/2
5/8	0.6267	0.6262	0.6252	0.6250	4	4 1/2
3/4	0.7520	0.7515	0.7502	0.7500	4	5
7/8	0.8770	0.8765	0.8752	0.8750	4	8
1	1.0020	1.0015	1.0002	1.0000	4	9
1 1/8	1.1270	1.1265	1.1252	1.1250	4	9
1 1/4	1.2525	1.2520	1.2502	1.2500	4 1/2	12
1 1/2	1.5025	1.5020	1.5002	1.5000	4 1/2	12
1 3/4	1.7525	1.7520	1.7502	1.7500	6	14
2	2.0025	2.0020	2.0003	2.0000	6	20
2 1/2	2.5030	2.5025	2.5003	2.5000	8	20
3	3.0030	3.0025	3.0003	3.0000	8	20

All dimensions are given in inches.

Material: This standard does not specify the material for guideposts. They are generally made from X1314 steel or equivalent, heat treated Rockwell C-62 to C-65.

NOTE: Longer lengths of guideposts than those tabulated in this standard are available. Oil groove in the guidepost may be optional with the supplier.



An example of Lenzites trabea—a common mold magnified seventy-four times.

Stop Sacrificing Profits!

Production delays and *costly waits* are the result when bacteria get into lubricants and coolants causing them to go "sour."

You can protect yourself against these profit-eating failures by using Dowicides. Dowicides, Dow's industrial germicides and fungicides, increase the service life of cutting, grinding, rolling, and hydraulic soluble oil emulsions by keeping the bugs out, thus reducing machine "down time." These tested materials, developed by The Dow Chemical Company, are available in both oil and water-soluble types.

Stop sacrificing profits! Investigate Dowicides today. Extensive Dow laboratory facilities are maintained to help you solve your problems. Contact your nearest sales office or write direct.

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Dowicides

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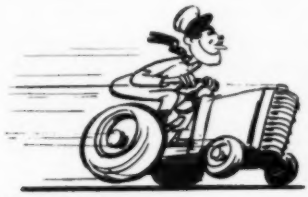
DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

TALKING SHOP



Hot Pilots

INDUSTRIAL PSYCHOLOGISTS say that workers need new experiences—and the younger the men, the greater the need. A case in point occurred at an Army supply depot at which industrial trucks and tractors showed a high accident rate. Personnel officers found the trucks manned by energetic, pre-draft men. Aisles were broad and inviting; gas for pleasure cars was scarce. The youngsters responded by trying to set new speed records with their trucks. A change to older men eliminated the trouble. Moral: don't tie your young men to routine jobs and expect them to be happy; they need variation in their day.

Fluorospection

THE GEIGER COUNTER, which detects radioactive materials and is currently the world's most popular prospecting instrument, has been adapted by the scientists of the research laboratory of U. S. Steel Corporation of Delaware to analyze steel samples. With proper adaptation this instrument is capable of measuring invisible fluorescent rays—each of a special kind—that emanate from a steel sample when its atoms are ionized by powerful X-ray. Thus, after proper calibration, the Geiger counter bears promise of being much faster than the direct-reading spectrograph to show quickly the kind of and quality of alloying elements in steel. All that is required is that the sample have a clean flat surface.

Present unit includes a 20-milliampere, 50-kv, molybdenum target X-ray tube to flood the specimen and excite secondary rays characteristic of the chemical elements alloyed with iron in the sample. These fluorescent rays are reflected through a narrow slit at right angles to the path of the primary X-ray, to a crystal monochromator. This crystal is in the center of a circle, ¼ of whose circumference is traversed by the counter in its motorized scanning operation. The counting circuit is connected to a self-balancing potentiometer which automatically plots the intensities of the various elements on graph paper. The system works best on elements having middle atomic weight, such as chromium, manganese, molybdenum, nickel and copper, as well as columbium, titanium, tungsten and vanadium. This setup will make quick non-destructive analyses possible and will permit closer control of steel specs.

Professional Engineer

LEGISLATION establishing the profession of engineering and providing for the licensing of qualified men is now in force in most states. It creates some queer problems, based on use of the term "engineer" by various groups for a hundred years or more. Railroads have engineers; industrial companies have many job classifications labeled "engineer"; power plants and design departments share use of the title "chief engineer." Can any legislation bar use of the title by certain of these groups—particularly in interstate operations?

Ohio has just faced the problem. It seems that the president of Aimes Co., Cleveland, a non-engineering graduate, designs and supervises fabrication of unloading machinery, so represents himself as an engineer. Cuyahoga (Cleveland) Court of Common Pleas enjoined him Nov. 12, 1947, on plea of the Ohio Society of Professional Engineers, from calling himself a professional engineer unless and until he was registered as such. Sept. 2, 1948, he was in court again for violation, and was fined $500 and sentenced to 10 days in jail. After he'd served one day, his appeal was granted. Now Ohio Court of Appeals has dismissed the contempt charges, holding that he had not used the term "professional engineer," and as the Ohio statute exempts those engaged in design and fabrication of manufactured products, he can advertise himself as an engineer as long as he confines himself to manufactured products. But he can't call himself a *professional* engineer.

Blasted Aluminum

WASHINGTON STATE shifted to aluminum for auto license plates, encountered two problems, poor paint adherence and glare from headlight reflections. The answer proved to be grit-blasting. Now all plates and highway signs are "Wheelabrated" to obtain the etched-like surface. Production is 70 plates per minute.

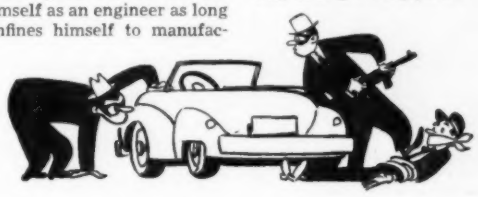
Control Engineers

CONTROL of modern processes and equipment is so important that a company licensing a new method will insist that the licensee include an electrical engineer in the group of trained technicians. With him, a die engineer and a metallurgist, it is felt that all aspects of the process, especially cycling for different parts, will receive necessary attention for successful production.

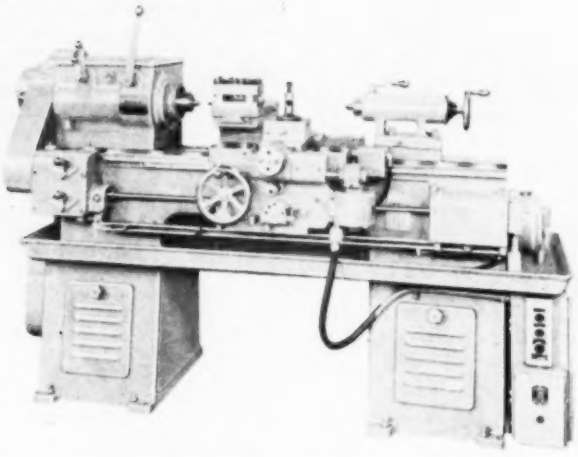
Style Stealing

CITROEN introduced a 2-hp car at last year's Paris Auto Show, but still hasn't begun commercial sale and hasn't released constructional details. In mid-September, two particularly curious gentlemen stopped a test car at machine gun point near Paris, bound and gagged the driver, then spent 45 min peering and poking around the car. Says our Paris man: "Here's what I was able to learn about the car." (We are cabling to ask who was with him for the holdup.)

The car is a 4-place, 4-door job with roll-back canvas top, capable of 50 mph with 4 people and 100 lb of baggage. At average speed of 35 mph, it is supposed to get 50 to 60 mph on foul 40-octane French gas. Drive is at the front like the Citroen 11- and 15-hp jobs, giving low center of gravity. The engine is a 2-cyl, 375-cc, 4-cycle unit, air-cooled. There are three forward speeds, plus overdrive and reverse, hydraulic brakes—and only four greasing points.



New Shop Equipment



Shown with normal speed geared headstock, LeBlond Clipper has 14⅞-in. swing over bed and carriage wings. Lathe can be operated automatically, semi-automatically, or manually.

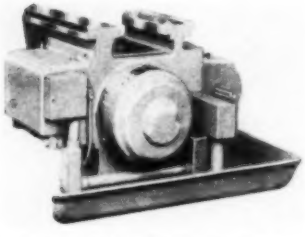
LeBlond Automatic Lathe Attains Speeds up to 3600 RPM

The Clipper high-speed manufacturing lathe runs automatically through a complete cycle, including plunge to depth, turn, tool relief, and rapid traverse to starting position. Starting point is determined by the position of the micro-length limiting switch on the bed, and length of cut by setting of the positive automatic length stop on the trip bar. A positive adjustable stop on the bridge of the carriage is set for desired depth of cut. Tools feed to depth angularly and turning is then controlled by the regular feed mechanism which moves the tool in and out electrically.

At the end of the cut the apron engages a positive automatic length stop which actuates a time-delay switch. In the interval tools are relieved and the traverse mechanism returns the apron rapidly to the starting position. Three headstocks are available. A regular anti-friction head for medium spindle speeds has two ranges of six selective speeds each: 68 to 400 rpm or 102 to 600 rpm. A high-speed anti-friction head has two ranges, each with six selective speeds: 200 to 1200 rpm or 250 to 15000 rpm. A high-speed head with motor built in at the headstock furnishes nine spindle speeds varying from 450 to 3600 rpm.

Swing over the bed and carriage wings is 14⅞ in. The Clipper bed is fitted with hardened and ground steel bed ways front and rear. An automatic back facing attachment, furnished as added equipement, is coordinated with the apron to work on regular automatic cycle. Pick-off gears vary the length of cross travel in relation to length of carriage feed.

The R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio



Traverse control mechanism, consisting of traverse reverse control and motor, returns apron and carriage to starting position.

Solid Carbide Mills Work Hard Materials

Seven different shapes are offered in the Severance 3/32-in. shank solid carbide Carbo-Mills series. Materials up to 60 Rockwell C can be worked with these cutters. The tools are of one-piece solid carbide construction. Carbo-Mills are 1⅜-in. O/A.

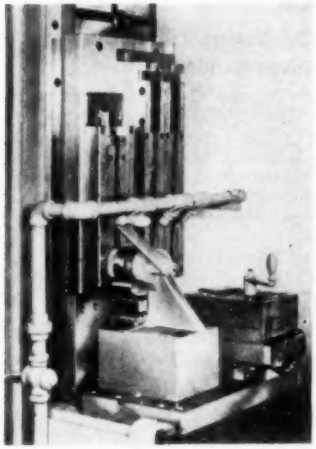
Severance Tool Industries Inc., Saginaw, Mich.

Hanna Pilot Valves Control All Sizes of Cylinders

These pilot valves are for direct control of small cylinders or automatic control of large cylinders. The cam lever and pushbutton types are three-way valves and the foot-operated units are four-way. Cam-operated valves have a spring-loaded roller which can be actuated by a straight-line or rotary cam. Roller can be rotated 90°.

Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.

Materials and Parts



Colonial "Ram-Press" tooled up for simultaneous slotting (at left) and surface broaching (at right). In left hand fixture several parts are slotted each stroke.

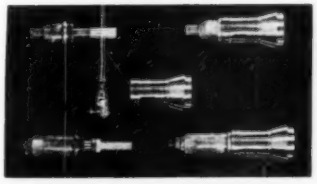
Large bracket, bolted to the top of the ram face, is for push-broaching or press-work. Columns are of heavy steel welded construction.

Low Cost Broaching Machine Is Multiple-Purpose Unit

The Colonial "Ram-Press," a universal ram-type hydraulic broaching machine, may be used interchangeably for all conventional broaching operations including surface broaching, internal push broaching, slotting, and press work. They are available in four-, six-, and ten-ton capacities and come in 24- and 26-in. strokes.

Columns are of heavy steel welded construction with hardened and ground ways the full length of the column for the ram slide. The hydraulic hookup, which provides excess capacity for occasional overloads, eliminates the necessity for cord passages in the machine leading to the cylinder. Pistons are of close grain cast iron with automatic type rings. Stroke adjustments are made by means of externally located collars on the trip rod alongside the ram. Machines can be furnished with special circuits for operating receding tables or fixtures, and special circuits can be installed for automatic clamping. The Ram Press is said to be ideally suited for shops where job runs of parts are to be put through. The coolant system has its own separate motorized impeller and separate start and stop controls for coolant and hydraulic pumps. The Ram-Press is said to be priced far below single-purpose ram type machines.

Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich.



Collets, Stops, Standardized For Brown & Sharpe Machines

Hardinge stop collets for Brown & Sharpe machines, come equipped with either solid stops or spring ejector stops. Collet sizes vary from 2½ to 4¼ in. in length and from 15/16 to 1½ in. OD.

Hardinge Bros. Inc., Elmira, N.Y.

...INCLUDING

Rotary gear finisher handles spur or helical gears and involute splines. The machine is completely automatic.....page 244

Automatic gaging and segregating machine checks all critical dimensions on automotive valve tappets .....page 248

Adjustable punch-tool set is for punching off-gage line holes as in webs of beams, channels and legs of plates.....page 250

Oil wells slip over die-set leader pins and automatically lubricate them. Oil is transmitted by capillary attraction.....page 252

Contour machine combines sawing, filing, and file broaching operations on metallic parts in small runs .....page 256

Single-action 650-ton hydraulic press employs dual-flow pumping system. Foot valve is directly connected to cylinder....page 264

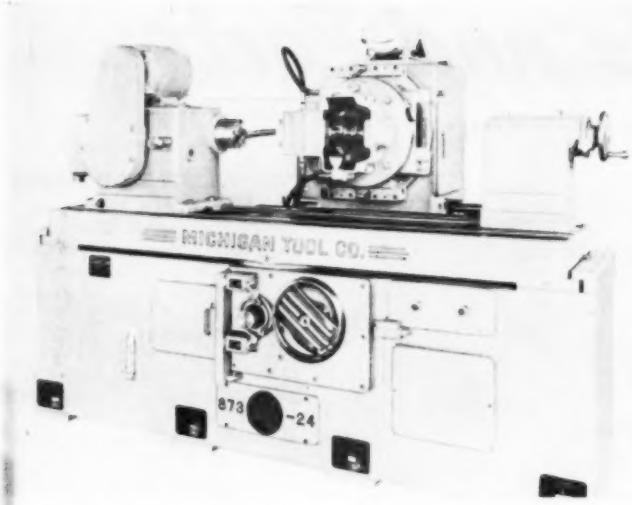
High-speed steel furnace combines preheat, high-heat, and quenching operations. Steel does not contact air until after preheat and quench are completed.....page 245

...and in Nov. 17

Saddle-type universal turret lathe for high surface speed metal removal which has 12-in. chuck capacity.

Boring, reaming, threading, and counterboring machine will handle all size flanges from 3-in. to 16-in. pipe size.

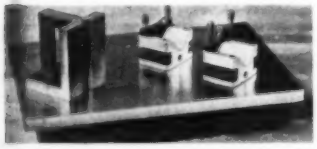
Hollow spindle lathe with 9-in. bore is rated at 20-in. size has 18-speed geared headstock with speeds ranging from 10 to 362 rpm.



Rotary Gear Finisher Is Completely Automatic

The Michigan Tool Company's Model 873 is a high-production cross axis rotary gear finisher. Completely automatic, the machine will handle spur or helical gears and involute splines from 0- to 24-in. dia. and up to 15-in. face width. Once the machine is set up for a given gear type, it is necessary only to load the gear between centers and push a start button to complete the entire operation. Model 873 will shave gears by the "underpass," "transverse," or "traverpass" methods. It can curve-shave (crown) wide-faced and narrow gears. A special interchangeable cutter head is available for finishing internal gears.

Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich.



Surface Plate, Accessories Available

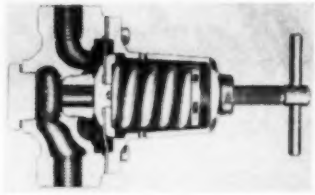
Precision ground with all edges accurately machined, this plate is made with close-grained iron of high wear resistance, and is heat-treated to prevent distortion. Bottom is heavily ribbed and has three-point support. The size is 12 x 17 x 3 in. with a top ¾ in. thick. Toolmakers' V-blocks are made of hardened steel with all surfaces precision ground. Each block is 15/16 in. wide and 1-15/16 in. high and 2¼ in. long. Capacity for round work is ¼- to 2-in. dia. Angle plate is precision ground on six sides and serves as a square for laying out and setting up work as well as for checking and finishing right-angle surfaces. Sizes—3¼ x 3¼ x 4¼ with ⅝-in. V groove.

South Bend Lathe Works, 378 E. Madison St., South Bend 22, Ind.

Air-Powered Electrode Dresser Has 1200 RPM Cutting Speed

Model 7165 is equipped with a cutter for reshaping copper electrodes on spot welding machines without removing the tips from the machines. The tool weighs only 3½ lb and employs special cutters which, at 1200 rpm cutting speed, are said to both cut faster and disburse chips. The unit has a ¼-in. pipe air inlet. The unit is 10⅝ in over-all length. Free speed—1500 RPM.

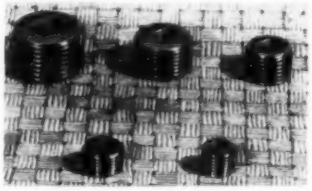
Aro Equipment Corp., Bryan, Ohio.



High Volume Relief Valve Allows No Blowdown

The "Series 62-A" diaphragm relief valve is suited to lines carrying air, cold water, oil insecticides, and similar liquids, at pressures up to 250 psi. Operation is fully automatic and the valve is said to give high volume relief without blowdown. Regulating springs are available in six sizes for relief pressure ranges of 2 to 15, 15 to 50, 40 to 75, 75 to 125, 125 to 250, and 5 to 125 psi. Valves are available in ⅛-, ¼-, ⅜-, ½-, ¾-, and 1-in. pipe sizes.

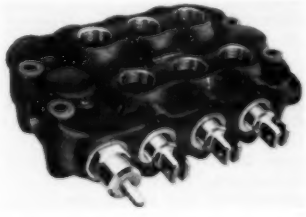
C. A. Norgren Co., 222 Santa Fe Drive, Denver 9, Colo.



Countersunk Pipe Plugs Precision Made

Tourek standard countersunk pipe plugs are made of specially selected steel on automatic machines. They can be furnished to special order in alloy steels, aluminum, or brass in sizes up to 2⅝ in. dia. Standard stock sizes are: ¼, ⅜, ½, ¾ and 1 in.

J. J. Tourek Mfg. Co., 4701 W. 16th St., Chicago 50, Ill.

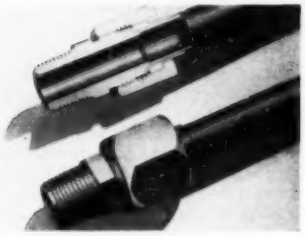


Oil Control Valve Operates Up to 1000 psi.

V8 series oil-hydraulic control valves are designed for large volume hydraulic systems including heavy-duty

industrial equipment and hydraulic presses. These valves will handle 80 gal. of oil per min. at operating pressures up to to 1000 psi. Models are available for operating up to as many as 3 single-acting or double-acting hydraulic cylinders. V8 valves are of Hydreco hollow-plunger construction with built-in check valves and adjustable differential relief valves.

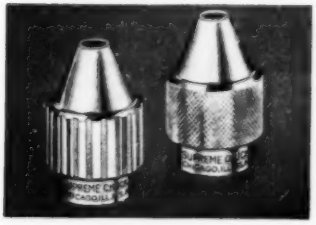
Hydraulic Equipment Co., 1100 E. 222nd St., Cleveland 17, Ohio.



Parker Triple-lok Tube Fittings In 477 Shapes, Sizes

Designed to meet the Joint Industry Conference Hydraulic Standards for Industrial Equipment, the Triple-lok fitting is a three-piece flared unit with a sleeve which acts as a lock washer, damps vibration, and prevents wiping of the flare during make-up. A 37° flare angle and dry-seal pipe threads are included in the design. Shapes stocked include male and female connectors, elbows, run tees, outlet tees, union, union tees, and bulkhead unions. Sizes range from No. 2 to No. 32.

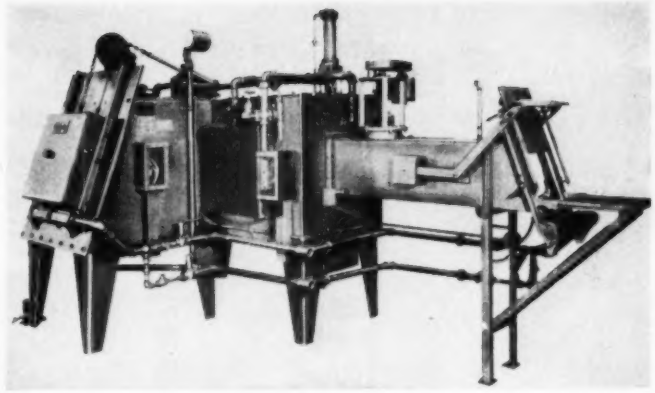
The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio



Hand-Lock Chucks Have ¼-in. Capacity

Supreme "Hand-Lock" chucks are available in both serrated and knurled models, each with ¼-in. capacity. They are made in ⅜-24 thread, ½-20 thread, and ½-24 thread, sizes. Jaws are of hardened alloy steel and the units are completely plated to resist rust.

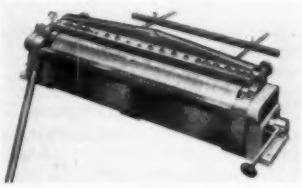
Supreme Products Inc., Chicago, Ill.



High Speed Steel Furnace Preheats, High Heats, Quenches

The Lindberg L high speed steel furnace was developed primarily to harden precision high-speed tools with fine cutting edges that cannot be ground or cleaned after hardening. This one unit combines preheat, high heat, and quench operations. Steel does not contact the air until after the preheat hardening and quench is completed, eliminating decarborization or carborization. High speed steels up to 2 in. can be fully hardened by the atmosphere quench. They are tempered from 1000 to 1100 F. The furnace may also be used for hardening all tools and dies, bright copper brazing, bright silver brazing and bright annealing.

Lindberg Engineering Co., 2444 West Hubbard St., Chicago 12, Ill.

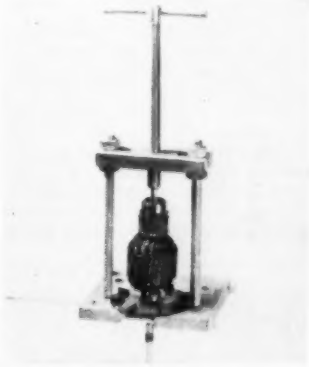


24-in. Box and Pan Brake Bends 16-Gage Sheet Steel

Finishing metal edges for straight seams and hems of many types, metal trim, flanges, tabs, boxes, and pans are typical operations of the Berkroy 24-in. Box and Pan Brake. This brake bends sheet steel up to 16-gage and up to 24-in. width to angles ranging from 0 to 135°. It folds a variety of complicated forms, including reverse bends and boxes.

The bending leaf is operated on Torrington Needle Bearings. There is 1-inch clearance between top fingers and anvil. By turning a knob, the positive cam-actuated angle stop provides inflinte adjustment to the desired angle shape.

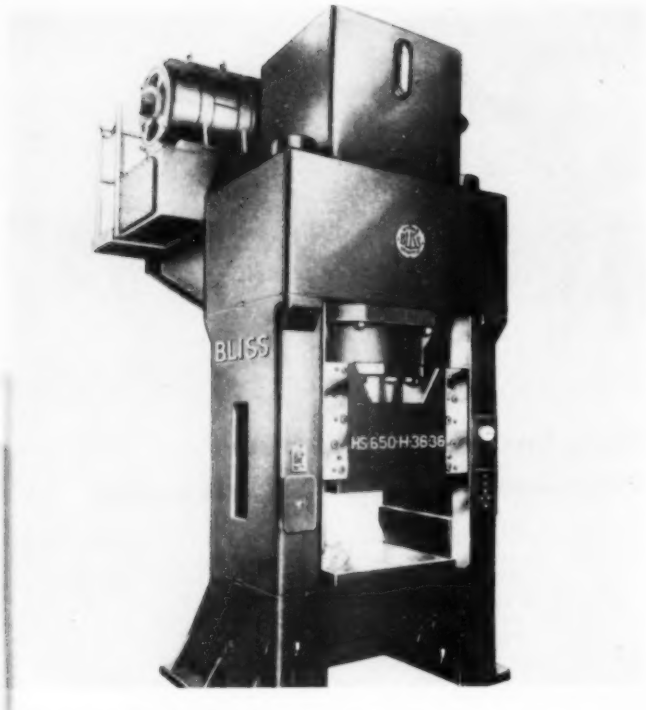
Berkroy Products Inc., 2516 N. Ontario St., Burbank, Calif.



Simple Tool Replaces Arbor and Step Plates

Weighing under 4 lb, this tool takes the place of an arbor and assorted step plates in removing and replacing fans, ball bearings, races, and seals from shafts, armatures, and similar units. The shaft range for this simple manual tool is from under ¼ to 1¼ in.

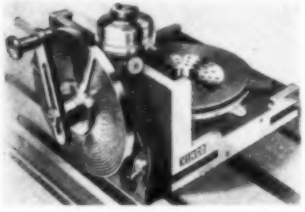
Double B Tool Co., 1561 E. 27th St., Cleveland 14, Ohio.



Single-Action Press Employs Dual-Flow Pumping

The simplified design of the HS-650-H-36-36, 650-ton single-action hydraulic press includes the elimination of interconnecting piping, a simplified circuit, and a dual-flow pumping system. It is built with prestressed tie-rod frame and unit design of frame, cylinder, and slide. Other construction features include (1) a foot valve directly connected to cylinder, (2) open-type prefill valve, and (3) four adjustable flat-type Meehanite gibs with removable wear strips on uprights. The pump design, permitting reversal of oil flow, provides a controlled gravity descent with smooth starting and stopping as well as smooth pressure release. Front uprights are straight to facilitate truck loading.

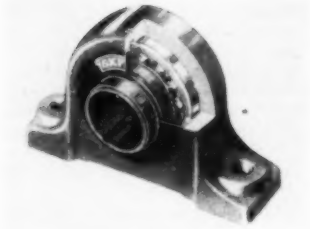
E. W. Bliss Co., General Office, 1420 Hastings St., Toledo 7, Ohio.



Precisiondex Indexing Fixture Adaptable to Wide Work Range

With guaranteed indexing accuracy of within 30 sec of the arc, the Precisiondex is adaptable to such operations as jig boring and grinding, light milling, surface grinding, drilling, engraving, profiling, light shaping, graduating, slotting, and inspection. All parts essential to its accuracy are precision ground and lapped. Two side surfaces and the bottom surface are flat and square within two tenths, permitting work to be done either horizontally or vertically. The unit mounts a micrometer equipped with ratchet and pawl arrangement. It is secured to the rim of the work place by means of a one-piece clamp.

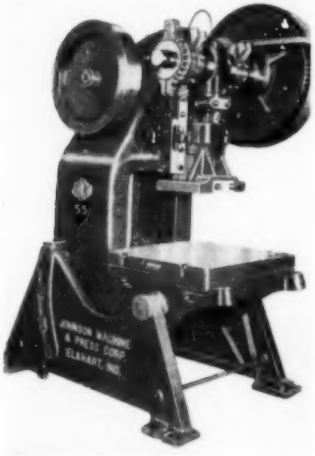
Vinco Corp., 9111 Schaefer Highway, Detroit 28, Mich.



SKF Unit Pillow Block Eliminates Lock Screws

Equipped with either ball or spherical roller bearings, this anti-friction bearing pillow block is for shafts revolving at high speeds. Its design includes a tapered inner ring and a tapered split sleeve which contracts and wraps around the shaft when the ring is pressed against it with a tightening nut. Floating seals prevent the leakage of lubricant and the entrance of foreign matter into the bearing. The pillow block is available in shaft sizes from 1 7/16 to 2 7/16 in.

SKF Industries, Inc., Front St., and Erie Ave., Philadelphia 32, Pa.



56-Ton Inclinable Press Presents Large Working Area

Equipped with a 32- x 34-in. bolster plate, the Model 55 press handles work up to 16¾ in. deep at 45 pieces per min in vertical or tilted (up to 36°) positions. Ram face measures 14 x 18 in., and the unit has 18-in. maximum opening. A tripping device protects the operator in event of spring breakage. Press frame is cast semi-steel and all points of greater stress are heat-treated.

Johnson Machine & Press Corp., Elkhart, Ind.

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If your sales organization can use the help of the American Society of Tool Engineers in BRINGING YOUR PROSPECTS TO YOU . . .

Write, wire, or phone for this booklet.

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Who are these tool engineers? A breakdown of registrations at the last ASTE Exposition shows that they hold the following positions in their companies:

President, Owner or Partner	13½%
Top Management Executives	17 %
Production Executives	25 %
Master Mechanics; Process, Methods & Production Engineers, Etc.	26 %
Chief Engineers, Development Engineers, Etc.	18½%
TOOL ENGINEERS	**100%**

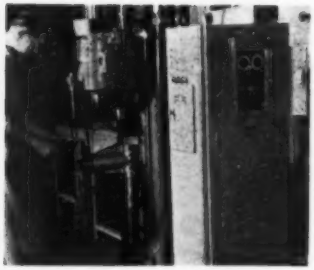
The booklet will tell you how many thousands of each there were . . . what kind of companies they represented . . . where they came from . . . what kind of products they came to see and buy.

And it tells you why EVEN MORE OF THE MEN WHO SPECIFY AND BUY will be at Philadelphia's Convention Hall & Commercial Museum next April 10th to 14th, looking for things that will cut their costs.

AMERICAN SOCIETY OF TOOL ENGINEERS

EXPOSITION COMMITTEE

10700 PURITAN AVENUE • DETROIT 21, MICHIGAN • UNIVERSITY 4-7300



Control Unit Refines Initial Welding Current

Called a slope control, this General Electric unit is designed to provide the desirable refinement of gradual increase in welding current at the beginning of the weld. Adaptable for either synchronous or non-synchronous single-phase resistance welding machines, this control materially reduces tip pick-up in spot-welding aluminum, magnesium, and their alloys. Laboratory tests with this control are said to have resulted in obtaining 20 times the number of spotwelds in 0.64-in., 24 ST Alclad aluminum before sticking occurred, than were obtained without the control.

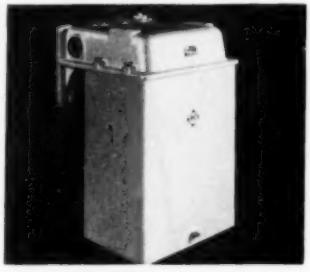
The slope control is furnished in two types: one for mounting on the side of synchronous controls, and the other in a separate inclosure for older types of control and non-synchronous control. The unit functions as a variable resistor placed in series with the heat control rheostat in the standard welding control panel. The value of this resistor varies with time, gradually increasing the welding current.

General Electric Co., Schenectady 5, N.Y.

Double-Piloted Valve Operates from 25 to 125 PSI

With a pilot cylinder which operates at pressures as low as 25 psi, these double-piloted single-plunger valves are considered well suited for use in safety control arrangements on presses, shears, cutters, and for air clutches and sequence operating cycles. The valve consists of an aluminum housing, a hollow stainless steel plunger with precision placed ports, and stainless steel pilot pistons mounted in brass pilot cylinders. The valves are available tapped for either ⅛- or ¼-in. pipe connections, in 2-way, 3-way, double 2-way, 4-way, and 5-way designs for use with air, oil, or water at line pressures up to 125 psi and normal temperatures not exceeding 150 F.

C. B. Hunt & Son, Inc., Salem, Ohio.

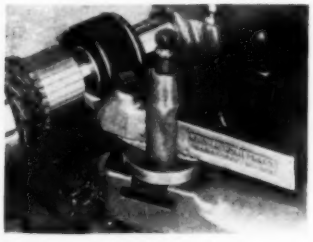


Full Voltage Starter Immune to Atmosphere

Wall-mounted full-voltage starter Type 371, is especially adaptable for use where corrosive vapors or combustible dust-laden atmospheres are present. Its entire mechanism, immersed in oil, is sealed from the atmosphere. The starter controls squirrel-cage motors and the primary of wound rotor motors of 300 hp or less at 2300 volts. A built-in drum type multi-stage auxiliary switch provides extra circuits when desired in the control system.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

SHEFFIELD AUTOMATIC VALVE tappet gaging and segregating machine checks all critical dimensions of an automotive valve tappet and properly segregates the acceptable, rejected, and salvageable parts. The machine has a capacity of 2000 parts per hr, and is operated by one man. It consists of a loading station, five gaging stations, five segregating stations, and two unloading stations. Protective switches at each station stop the machine immediately in case of jam, and a fixed snap gage in the top of the loading chute prevents excessively oversized parts from entering.—*Sheffield Corp. of Dayton, Ohio.*



Collet Bushing Chuck Supports Centerless Shafts

The South Bend adjustable collet bushing chuck accommodates centerless shafts from ¼- to 1-in. dia concentrically in lathes. It is manufactured with No. 2 or No. 3 Morse taper shanks for use in either headstock spindle or tailstock spindle of the lathe.

South Bend Lathe Works, South Bend 22, Ind.

Four typical machine shops report

"LONGER TOOL LIFE"
"BETTER FINISH"
"FASTER OPERATION"
} *WITH NEW*

J&L *FREE-CUTTING* "E"* *STEEL*

J&L STEEL

Four typical examples, taken from 100 case histories, show superior machinability of J&L "E" Steel.

For 4 years before "E" Steel was publicly announced, this new, free-cutting bessemer screw stock was tried by independent machine shops throughout the metal-working industry.

More than 6,100 tons were tested in over 100 applications!

Here are quotations from 4 typical case histories:

CASE HISTORY #1 ". . . tool life increased 100% at normal speeds . . . better finish . . . shop people liked it."

CASE HISTORY #2 ". . . tool life increased up to 200% . . . uniformity of finish remained constant . . . considerably increased speeds without sacrifice to finish."

CASE HISTORY #3 ". . . tool life increased two to four times . . . we were able to tap 1" full internal pipe thread, almost impossible on regular material."

CASE HISTORY #4 ". . . new steel machines very well . . . finish excellent . . . tool life increased . . . 5 to 10% better production."

You too can get greater economies in your machining operations with new J&L free-cutting "E" Steel. "E" Steel is available in three grades: E-15, E-23 and E-33, each within the composition limits of the standard bessemer screw steels and with similar tensile properties. All standard sizes and shapes are available. For further information write for your copy of our new booklet: "J&L 'E' Steel."

Jones & Laughlin Steel Corporation
402 Jones & Laughlin Building
Pittsburgh 19, Penna.

Please send me a copy of "J&L 'E' Steel."

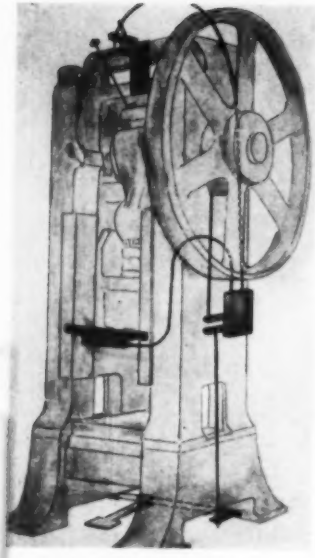
Name_____

Company_____

Address_____

JONES & LAUGHLIN STEEL CORPORATION

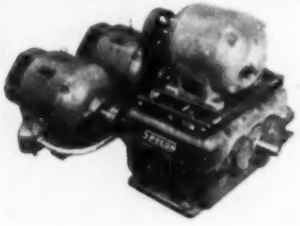
* "E" STEEL IS QUALITY-CONTROLLED FROM OUR OWN MINES THROUGH THE FINISHED PRODUCT



Punch-Press Safety Guard Protects Operators Hands

The Dayton Rogers two-hand non-repeat punch-press safety guard makes it impossible for the operator to place his hands in the working zone of the press during the working cycle. The work cycle of the press can be started only by placing both hands on the safety guard levers. The non-repeat mechanism provides positive one-stroke operation. This mechanism can be installed on any straight-side or inclinable press.

Dayton Rogers Mfg. Co., 2824—13th Ave. South, Minneapolis 7, Minn.



Speed Drive Gives Infinite Speed Range

The Specon ED electrical differential speed drive consists of a standard ac squirrel-cage motor, coupled with two dc motors through a differential gear box. The unit gives infinite speed ranges with constant torque under fully automatic control. For processing web materials, constant tension or decreasing tension may be maintained between a machine and a winding stand, or between two parts of the processing machine. The dc motors run at varying control speeds within a limited 3:1 range, and are the means of controlling the torque and unlimited speed range of the output shaft. The driving motor may be mounted either horizontally or vertically, and the unit is available in any required size or capacity.

Speed Control Inc., 1334 Depot St., Wickliffe, Ohio.

Indicator Gage Checks Gears and Splines

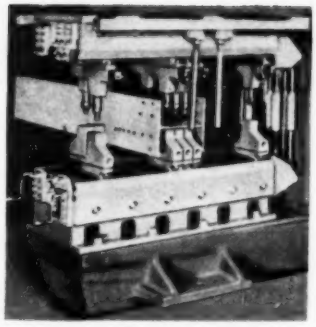
The MP PD-Matic, equipped with basic rack teeth and dial indicator, is for fast, simple, and accurate checking of gear and spline, sizes and tapers. Checking can be done without disturbing the mounting of the part. The PD-Matic simplifies calculations of gears and involute spline sizes, because it eliminates necessity of employing involute functions.

MP Tool and Engineering Co., 2339 Caniff Ave., Detroit 12, Mich.

Corrugated Steel Platforms Hold Heavy Loads

For use with any type lift truck, these custom-built corrugated all-steel platforms are cold pressed from sheets of formed corrugated heavy-gage steel. They can be equipped with knee braces and bumper channel runners and are available in any dimensions and underneath clearance requirements.

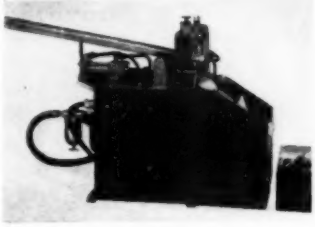
Palmer-Shile Co., 16019 Fullerton Ave., Detroit 27, Mich.



Adjustable Punch-Tool Set For Off-Gage Line Holes

Fitting any Beatty toggle-beam punch, this adjustable set of punch tools is for punching webs of beams and channels and punching legs of angles and plates. Tools are designed to provide both quick initial set-up and instantaneous shifting of punch and die positions for off-gage line holes. Punch and die units move together as a unit with movement controlled by a hand crank.

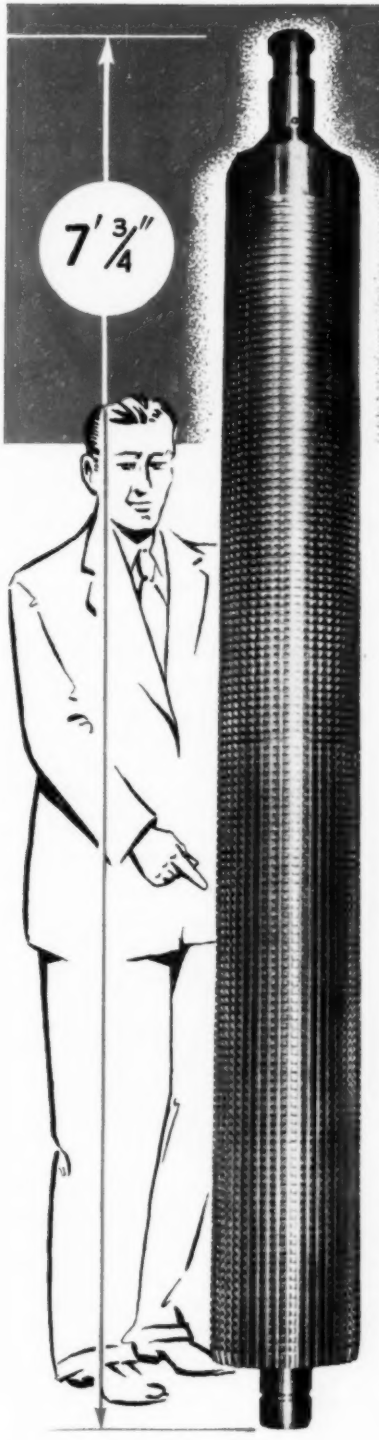
The Beatty Machine & Mfg. Co., Hammond, Ind.



Sorting and Gaging Units Tailored to Product Needs

Capable of segregating a product into any number of categories, each of any dimensional widths, the Brown & Sharpe special-automatic and semi-automatic inspecting and sorting equipment can be made to meet individual needs for volume of product. They are available with manual loading and disposal; manual loading and automatic disposal; or automatic loading and automatic disposal. The machine illustrated gages and sorts straight sleeves into four categories measuring for length and diameter at both ends. It has a production rate of approximately 3000 units per hour. Capacity is adjustable for different lengths and diameters. This machine is manually loaded and has automatic disposal.

Brown & Sharpe Mfg. Co., Providence 1, R.I.



1/2 TON INVOLUTE SPLINE BROACH

produced by

DETROIT BROACH

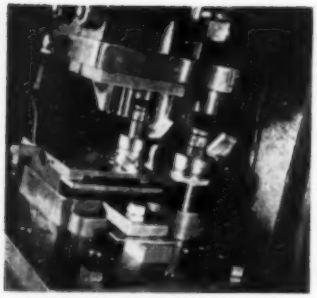
Cutting section of this broach is made from the largest High Speed Steel forging ever produced.

This giant broach was designed and built by Detroit Broach Company to produce the 44-tooth involute spline in ring gears for truck rear axles. Measuring 84¾" long and 9⅜" O.D.—used on a standard fifty-ton horizontal broaching machine with a 72" stroke—it removes 2¼ lbs. of metal on each stroke. The axle manufacturer now reports that cutting time on this operation was cut from 44.8 minutes to 0.7 of a minute with this broach (a reduction of 98.4%). In addition, handling is reduced since it previously required 2 operations to complete the teeth whereas broaching does it in one operation. The original cost of the broach tooling is only ⅓ that of the previous method, and tool sharpening costs are reduced 12 times.

Specializing in the design and manufacture of broaches and broach tooling exclusively, Detroit Broach is thoroughly qualified to analyze *your* splined parts and then create tools that will economically produce them to required tolerances. Call in your local Detroit Broach representative or write for one of our application engineers to call. He will gladly study your jobs and give you broaching cost and production data on them. You're sure to find that it's one way to cut today's manufacturing costs.

DETROIT *Broach* COMPANY
20201 SHERWOOD AVENUE
DETROIT 12, MICHIGAN

Detroit Broach has produced involute spline broaches as small as .125" hole diameter with five splines. Also producers of straight and spiral spline broaches, spline sizing and burring broaches, and all types and sizes of surface broaches and tooling.



Oil Wells Automatically Lube Die Set Leader Pins

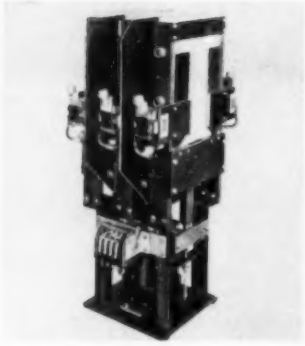
Requiring no attention other than filling, and specially adaptable for high speed long runs, these oil wells, which slip over the pins, automatically lubricate die set leader pins. The oilers are interchangeable among die sets having the same diameter pin. Oil is transmitted to pins by capillary attraction on each upward stroke of the press. Pin oilers are available in range of sizes to suit various leader pin diameters.

Acro Metal Stamping Co., 338 East Reservoir Ave., Milwaukee, Wis.

Silicone Rubber Stock Can Be Machined, Formed

Molded, extruded, punched, and lathe cut rubber parts are being fabricated from No. 250 silicone rubber stock. This material is recommended for application requiring good mechanical strength and resilience at temperatures below –50 F., and above 200 F. It is said to combine high tensile strength with good elongation. Parts fabricated from silicone No. 250 are resistant to ozone, tricresyl phosphate, and the chlorinated hydrocarbons in liquid-cooled transformers.

The Stalwart Rubber Co., 218 Northfield Road, Bedford, Ohio



Air-Brake Contactor Adaptable for Breaking, Reversing

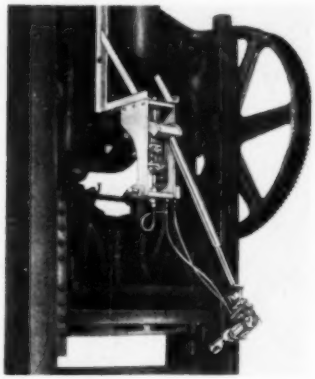
Fifteen inches wide, 25 in. deep and 38 in. high, the Type 256 high-voltage air-brake contactor has double-break contacts which halve the arc voltage and double the rate of dielectric recovery. This plus a vertical direct-action solenoid magnet eliminates the need of flexible leads, turning shaft, and shaft bearings. The unit is available with mechanical and electrical interlocks for reversing or dynamic breaking service.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Greyhound Spot Welder Is Portable, Self-Operating

Weighing only 23 lb, the Greyhound portable spot welder is said to be sturdy enough for heavy-duty industrial work. It is available in both 110- and 220-volt ac models, 50-60 cycles, and welds up to ⅛-in. combined thickness of metal, including stainless steel and mild steel, and up to 2 pieces of 18-gage galvanized. Copper arms are available in three interchangeable lengths, 6, 12, and 18 in. A spring attachment in the handle of the welder automatically opens the welding tongs on removal of finger pressure reducing the possibility of arcing and burning tips when not in actual use.

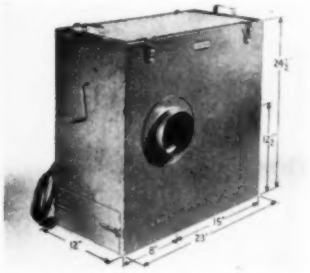
Greyhound A. C. Arc Welder Corp., 606 Johnson Ave., Brooklyn 6, N. Y.



Sahlin Iron Hand Produced in Junior Size

Designed to accommodate small and medium sized punch presses, the Sahlin junior size iron hand automatically removes sheet - metal stampings from press beds. It is recommended for units with bed widths ranging up to 72 in. and pressure capacities up to 250 tons. Made of steel plate with hardened steel jaws, the iron hand can remove parts weighing 20 lb or more.

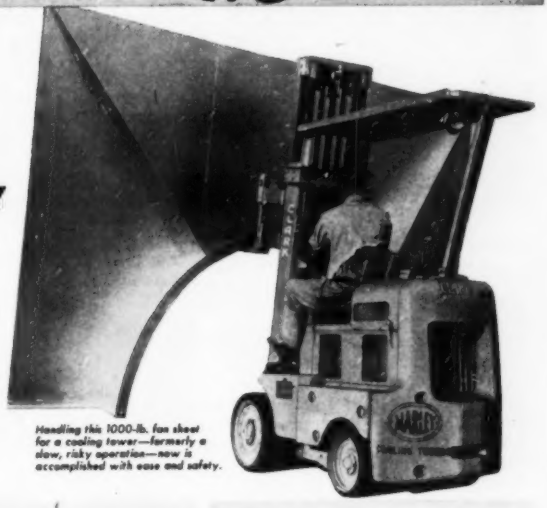
Sahlin Engineering Co., 462 South Woodward Ave., Birmingham, Mich.



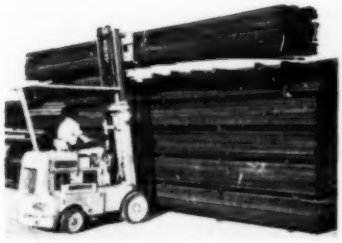
DUST COLLECTOR, Model 420, called the DUSTKOP, is powered by a 1/3-hp motor which directly drives a histatic paddle wheel fan. The unit is to be used on polishing, buffing, and grinding operations involving larger wheels and bigger volumes. It can handle 437 cfm on a 4-in. inlet pipe and attains static suction of 3.2 in. H_2O with a velocity of 7300 fpm when tests are made with 3-in. inlet pipe— *Aget-Detroit Co., Ann Arbor, Mich.*

MATERIAL HANDLING *News*

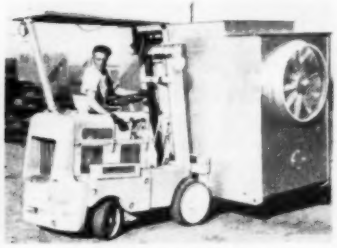
CLARK can INCREASE PRODUCTION CAPACITY and SLASH PRODUCTION COSTS for *You, Too!*



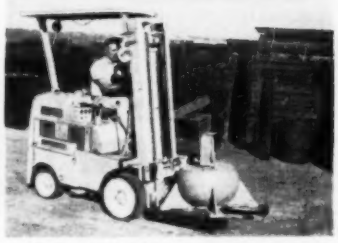
Handling this 1000-lb. fan sheet for a cooling tower—formerly a slow, risky operation—now is accomplished with ease and safety.



Orderly storage plus the versatile speed and strength of Clark fork-lift trucks has solved the basic problem of handling 5000 items for this manufacturer.



There's a place for every item—and every item is in its place when Clark Methods and Machines are on the job.



By the old method, handling heavy units like this gear-reduction unit was slow, difficult and often dangerous. It's simple enough now.

AS BUSINESS becomes more and more competitive, and as the opportunities for profits become more and more evasive, employment of Modern Materials Handling Methods and Machines is a MUST.

In manufacturing plants, warehouses, distribution and other commercial facilities which have adopted Clark methods and machines, management testifies enthusiastically to their great worth. "How did we ever get along without them!" is a common reaction after installation of this modern handling system.

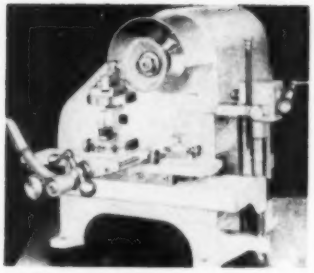
Clark's long and notable success in developing methods and machines to bring materials-handling costs down from the ridiculous to the sublime, has earned it the position of *Leader* in its field. In this capacity, it is equipped to solve *your* materials-handling problems—to help *you* achieve a satisfactory break-even point. This it has done time after time in practically every field of industrial and commercial enterprise. Clark Boosts Profits by Cutting Costs—and the "operation" is painless!

Write for Material Handling News

How a great many leading businesses are conquering costs—with quick and substantial profit to themselves—is described and illustrated in Material Handling News and in Clark's invaluable motion pictures. You can enjoy the benefits of both by requesting them on your business letterhead.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIV., CLARK EQUIPMENT COMPANY BATTLE CREEK 3, MICH.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS



Gopher Tool Grinder Has Quick-Change Fixtures

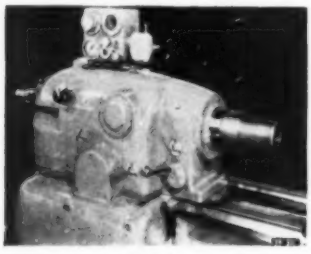
Equipped with a precision-built spindle the Gopher tool grinder grinds all automatic screw machine and turret lathe tools including chasers, circular form tools, dovetail tools, block tools, and toolbits. Changes from one fixture to another and from one set-up to another can be accomplished within one or two minutes. The machine comes equipped with a 3¼ x 1¼ x ½-in. flared cup wheel and 5 x ½ x ½-in. straight wheel and is driven by V-belt from ¼-hp motor. It can be operated on a 110 volt ac line.

Gopher Machine and Engineering Co., 3333 University Ave., S.E., Minneapolis 14, Minn.

Non-Scaling Compound Cuts Heat-Treating Costs

Phoenix Brand non-scaling compound is said to virtually eliminate decarburization, scaling, pitting, surface film, and excessive discoloration during heat-treating of steels. It is a powder which can be used in any furnace except the bath type.

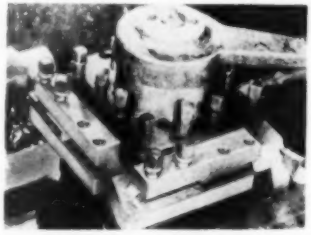
Parker Stamp Works, Inc., 600 Franklin Ave., Hartford, Conn.



Air-Operated Collet Increases Lathe Output

Developed to reduce operator fatigue on long production runs the Monarch air-operated collet attachment is said to increase the output of this company's 10-in. precision manufacturing lathe and its Speed-Matic hand-operated screw machine. The collet unit is of the pusher type and permits the use of a bar feed attachment. It is controlled by two push-buttons in the headstock of the machine. Applied to the cam lock spindle nose of either lathe, the collet adapter takes standard collets and accommodates sizes handling from ⅛- to 1-in. round stock. The attachment is only available for factory application to moderate precision manufacturing and Speed-Matic lathes.

The Monarch Machine Tool Co., Sidney, Ohio.



Lathe Tool Holder Permits Larger Cuts with Smaller Tools

Adaptable to turret lathes and other lathes with square tool posts, this toolholder was designed to enable shops to standardize on one size tool at a lower cost. It is said to facilitate the use of ½-in. tools on jobs that would normally require large ones. Tools are held in the holder by two screws and can be used from either end for turning, facing, or short-boring operations. The holder is available in two sizes, one replacing the 1-in. tool, and the larger size replacing the 1¼-in. tool.

Rusnok Tool Works, 4840 W. North Ave., Chicago 39, Ill.

Slide Rule Determines Force Required for Broaching

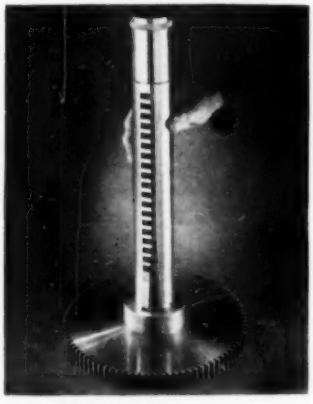
Measuring 3 x 6½ in., this slide rule calculator determines the force required for broaching any part whether of cast iron, various types of steels, bronze, aluminum, magnesium, or plastics. Applicable to either surface broaches or round splice serration and keyway broaches, the calculator quickly checks the suitability of broaching machines for a given job. Plastic covered for durability, it is printed in four colors to simplify reading of the 12 separate scales. The price is $1.

Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich.

Double Reduction Speed Reducer Adapted for Turntables

With speed reduction ratio range from 10 to 1 to 3840 to 1, the Model V-2 vertical type double-reduction speed reducer is adapted for turntables and other vertical applications. The input capacity is ½ hp with 1000 in.-lb output torque. The input shaft is ⅝-in. dia and output shaft is 1 in. Oversize shafts are available upon specification.

Euclid Universal Machine Inc., 15002 Woodworth Road, Cleveland, Ohio.



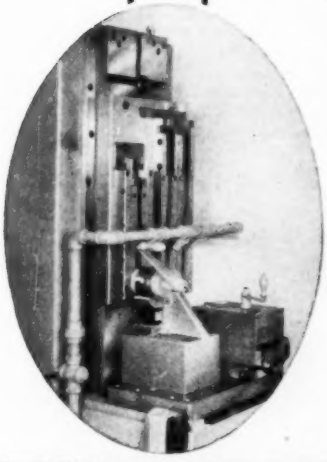
Kase Machine Company Produces "Jumbo" Broach

Interchangeable cutting blades of any width up to ⅝ in. can be furnished for the "Jumbo" broaches which are available in 1-9/16, 1-¾, 1-7/7, 1-15/16, 2 and 2-½ in. dia sizes. Cutting blade is moved back and forth in the taper milled slot in the broach body by means of end nuts to adjust depth of cut to individual job specifications. Jumbo broaches can cut keyways in a wide range of large bore diameters.

The Kase Machine Co., 18422 Buffalo Ave., Cleveland 19, Ohio.

Now— A BROACHING MACHINE THAT WILL DO ALL 4

1. Internal Push Broaching
2. Surface Broaching
3. Slotting
4. Press Work



at a price far below single-purpose ram type broaching machines

Available in 4, 6, and 10 ton capacities and in 24 and 36 inch strokes

The New "Ram-Press"

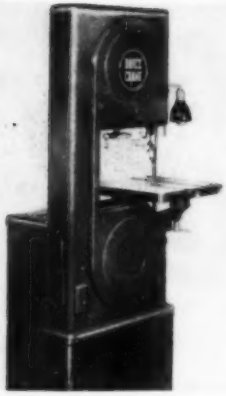
PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

For complete information on this revolutionary machine—designed to bring the cost of broaching equipment within the reach of practically any plant—no matter how small—

Ask for Bulletin #RP-49



Contour Machine Combines Sawing, Filing Operations

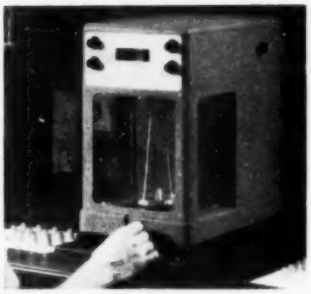
With blade speeds ranging from 92 to 4100 fpm, this portable combination contour saw and band filer is said to permit great time saving in cutting, filing, and file broaching on small-run production and maintenance parts. The machine cuts tool, bar, and sheet steel; brass, aluminum, transite, cast iron, and bronze and files a variety of metals. An automatic electric blade butt welder facilitates high-speed inside contour sawing. File bands, available for all purposes, have self-aligning ends. The 15x15-in. heavy ribbed cast worktable is mounted on two heavy cast trunnions. The frame is of tin gage solid welded steel. Floor models include a steel cabinet stand which provides a sealed-off, dust-free motor and gear-box compartment.

Boice-Crane Co., 935 Central Ave., Toledo 6, Ohio.

Simple Speed Control Device Infinitely Variable

The operating principle of the "Zero-Max" is crank motion on the input shaft creating linear motion which is absorbed on the output shaft by a series of one way over-riding clutches. Speed can be varied from zero to a 4:1 ratio. The smallest unit with output torque capacity of 10 in.-lb, is 4 x 2¾ x 1¼ in. and sells for $12.95 without case.

Revco Inc., Dept. AM, 405 Thorpe Building, Minneapolis, Minn.

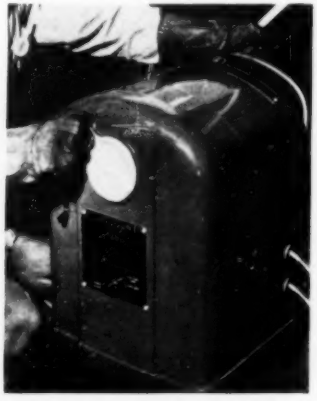


Single-Pan Analytical Balance Weighs Small Parts to 0.05 MH

Weighing small finished parts ranging from 0.0001 to 200 grams, the Gram-atic Balance is accurate to 1/20 of a milligram. It has only one pan and weights are read directly on a scale at eye level. All required weights are built in and manipulated by turning four external knobs. No weights are handled and weights less than 0.1 grams are indicated optically and automatically. The balance is recommended for production control at test stations.

Fisher Scientific Co., Pittsburgh, Pa.

AUTOMATIC "AIRLECTRIC" gaging, classifying, and segregating machine gages connecting rods for all critical dimensions and conditions, stamps them with proper classification, and segregates them at a rate of one every five seconds. Among the dimensions checked are the true diameter, average diameter, out of round taper, squareness of face with bore, center distance between holes, width and hand twist. The machine can be run by one operator who loads the connecting rods on 8 continuously rotating locating platforms—*The Sheffield Corp., Dayton 1, Ohio.*



Industrial AC Welder Equipped With Arc Booster

"The Fleetwelder 200" is a NEMA rated unit with reserve capacity over its rated maximum load of 250 amp ac. Electrodes ranging from 5/64- to ¼-in. dia can be accommodated. A Lincoln arc booster adjusts the welder to start the arc automatically the instant the electrode touches the work on either thin or heavy material. The unit is equipped with wheels for portability, weighs 319 lb, and is priced at $180.

The Lincoln Electric Co., Cleveland 1, Ohio.

"Clean As A Whistle"
TO MAKE and TO USE

...and you can say that of any vac built with American Phillips Screws

CLEANER PRODUCTION: No scarred parts, no slashed hands, no floors littered by fumbled screws. For when an American Phillips Screw is put on the point of its 4-winged driver . . . then they become one straightline unit until the recessed screwhead is turned up flush and tight . . . the *first* time, *every* time. Saves rejects, saves screws, *saves time up to 50% over out-of-date slotted screws.*

CLEANER SALES: Buyers of modern, top-quality products know the buy-sign of the universal Phillips crossed recess on everything from their automobiles to their golf clubs. To them, the Phillips recess means that when a product is so put together, *it stays put.* To you, it means fewer returns and fewer free servicings, especially where vibration is involved. So remember, from both viewpoints . . . production and sales . . . *American Phillips Screws always cost least to use.*

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND
Chicago 11: 589 E. Illinois St. Norristown, Pa. Detroit 2: 502 Stephenson Building

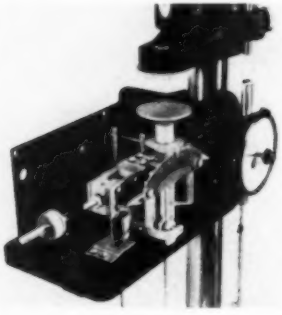
AMERICAN PHILLIPS *Screws*

ALL TYPES
ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

Endless Band Cutter Cuts All Solid Materials

Employed to cut every known solid, the DoAll Contour-matic is an endless band cutter. It is equipped with a stepless variable speed device and has a speed range of 40 to 10,000 fpm. It is hydraulically operated throughout. The worktable is especially designed for holding the work to be machined and operates through a variable hydraulic power feed cycle of 16 in.

The DoAll Co., Des Plaines, Ill.



Spring Tester Sensitive to Less Than 50 MG Load

Testing of any type of small spring (coil, flat, special design, or spring assembly) within the limits of 12-in. length and 5-lb load can be accomplished with the Baldwin Hunter Spring Tester. Designed for high production operation, it is especially useful for springs made of wire sizes from 0.005 to 0.030 in. in diameter. The equipment is sensitive to load changes in less than 50 mg and has a weighing accuracy within ±0.10 percent.

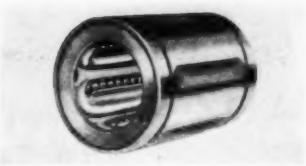
Vernier adjustment of compression and extension heads enables fast accurate determination of compressed or extended length of springs for a given load. Measurements are made on a dial indicator accurate to ±0.001 in.

The Baldwin Locomotive Works, Philadelphia 2, Pa.

Dry Lubricant Stable At High Pressures, Up to 750 F

A specially prepared smooth-textured molybdenum-compound powder, designed particularly for extreme bearing pressure applications, Molykote Type Z, is reported to have exceptional chemical and thermal stability and inertness. It resists the attack of all but a few acids and its lubricating characteristics are not affected from sub-zero to 750 F. According to manufacturers, tenacious adherence to metal surfaces and exceptional film strength of this lubricant prevent galling and seizing at bearing pressures in excess of the yield strength of most metals. Type Z may be applied dry or in solvents.

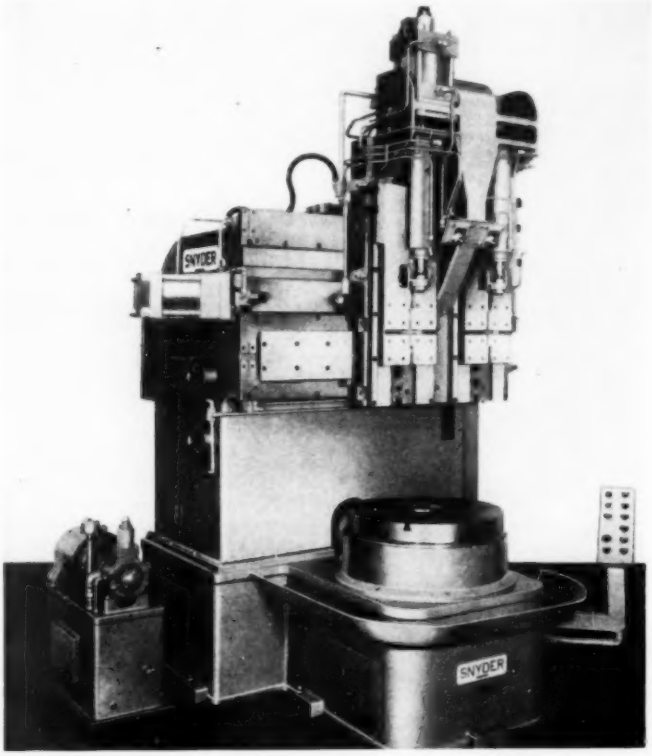
The Alpha Corp., Greenwich, Conn.



Linear Ball Bearing Bushing Supports Reciprocating Shafts

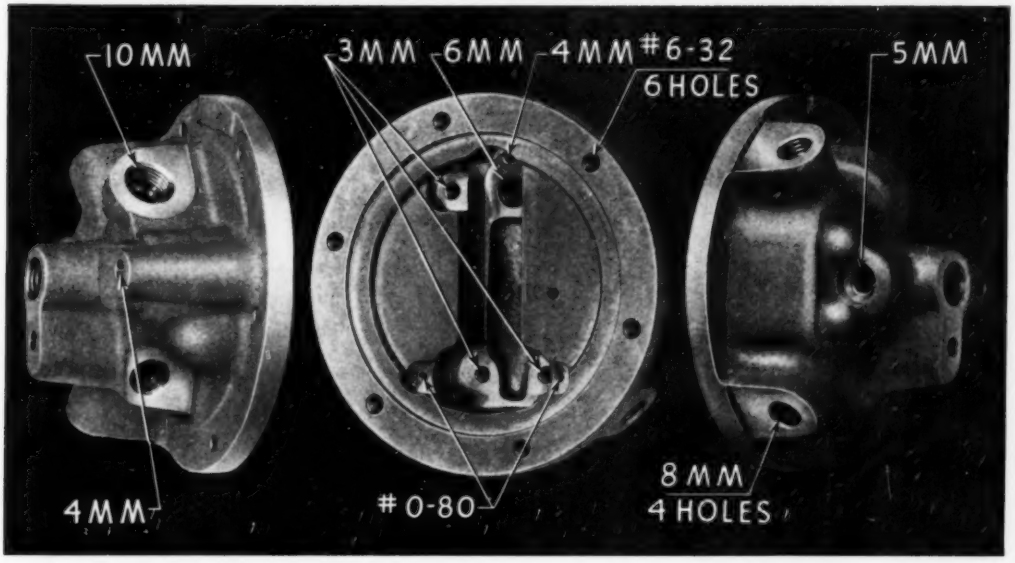
Designed to give anti-friction support to linear motions along 1½-in. dia guide rods or reciprocating shafts, the Thomson Ball Bushing has an OD of 2.375 in. and an over-all length of 3 in. The unit is not dependent upon grease for lubrication and allows an unlimited stroke length.

Thomson Industries, Inc., Manhasset, N. Y.

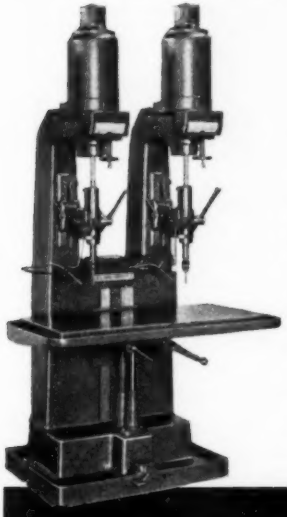


HEAVY-DUTY VERTICAL HYDRAULIC LATHE was built for special application in the manufacture of car and truck components, but is adaptable to facing, boring, or turning by changing the fixtures and toolholders. Vertical welded steel column carries a hydraulically operated, horizontal cross-slide upon which are mounted two hydraulically operated vertical tool slides. Horizontal slide has 21-in. stroke, and vertical slide has 14-in. stroke. A 30-in. variable-speed rotating table is mounted on the base. Power is supplied by a 15-hp motor. Required floor space is 70 x 100 in—*Snyder Tool & Engineering Co., Detroit, Mich.

Can you top this for tapping?



All these gas tight, fine thread holes tapped as routine production



by AMERICAN GAS ACCUMULATOR COMPANY
on a LELAND-GIFFORD
No. 2-LMS Reversing Motor DRILLING MACHINE

Lighthouses, airway beacons, airport lights . . . to assure unfailing operation of these vital units, American Gas Accumulator Company of Elizabeth, New Jersey, builds them with instrument precision. Shown here is only one of many critical parts tapped by AGA on a standard Leland-Gifford No. 2-LMS Drilling Machine with reversing motor control for tapping.

Note the range of sizes — all the way from *#0-80* (pitch dia. 0.0519″) to *10 mm.* (pitch dia. 0.3554″) — in tough Navy Bronze with all tapped holes gas tight. The same machine, incidentally, is used to tap full depth ¾″-14 Whitworth pipe threads (1.063″ OD). Between tapping jobs — with a flick of a switch and a quick tool change — it does double duty as a drilling machine — accurate, sensitive and with a wide range of spindle speeds.

Think what a production drilling machine like this could do for you in your shop or toolroom . . . tough jobs made easy, time saved, costly operations made profitable. Look into it today. Write for complete information.

PRODUCTION MEN

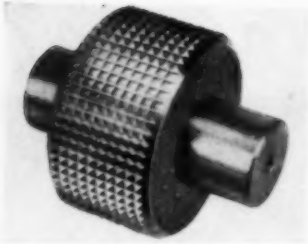
Get This Handy Slide Rule

A valuable aid in figuring costs and setting production schedules. Quickly gives time required to drill holes of any size and depth in any material. It's free. Write the nearest office.

LELAND-GIFFORD
Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 6, 565 W. Washington Blvd.; DETROIT 26, 1533 Dime Bank Bldg.; CLEVELAND 1, P. O. Box 5547; NEWARK 2, Industrial Office Bldg.; ROCHESTER 1, Commerce Bldg.; LOS ANGELES 14, 724 So. Spring St.



Kennametal Knurling Wheel For Roughing Mill Rolls

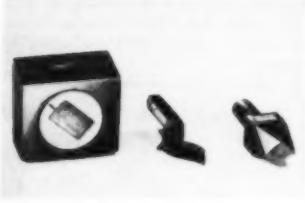
Supported on a solid Kennametal pin, this solid Kennametal knurling wheel for roughing mill rolls is said to last up to 100 times as long as steel wheels before regrinding is necessary. Wheels are made to suit customer's requirements.

Kennametal Inc., Latrobe, Pa.

Stabilizing Mechanism Doubles Brush and Commutator Life

Designed for GE frictional hp motors in portable electric tools, this brush stabilizing mechanism counteracts the wedging effect of commutator and causes brush to ride freely in the brush holder. It is interchangeable with standard mechanisms as outlined in the NEMA standardization of series wound motor parts.

General Electric Co., Schenectady 5, N. Y.



Engraved Dies, Stamps In Acromark Line

Coining die (left) is for stamping watch dials, fine instrument dials, fine design trade marks, and emblems from stainless steel, gold, silver, brass, or copper. Gooseneck stamp used with hammer carries fine raised letter engraving on the impression face curved to mark inside of a bushing collar or ring. Shank style design and lettering die carries fine engraving such as intricate trade mark designs and company names. This die is used on a foot press or small punch press.

The Acromark Co., 713 Morrell St., Elizabeth, N.J.

Cleco Edge Grinder Runs to 8000 rpm

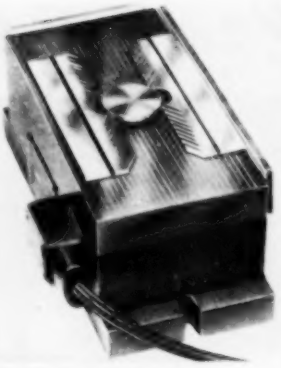
The Cleco 1480 edge grinder is for use on ferrous and non-ferrous metals, and is said to be particularly well adapted for work on stainless steel, bronze, brass, and aluminum. Free speed is 8000 rpm, weighs 8¾ lb, handle length 10¼ in., and capacity 7-x ¼-in. flexible wheel.

Cleco Div., Reed Roller Bit Co., P.O. Box 2119, Houston 1, Texas

Socket Screw Key Sets Come in Plastic Packs

Made of special analysis nickel alloy steel, Holo-Krome key sets come in light weight strong plastic packs. Some of the sets have individual pockets for each key. Different sets are especially suited for different types of work such as servicing instruments, radios, and motors; for electrical appliance work and other light jobs; or for service men on oil burners and television sets.

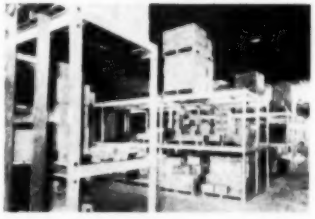
The Holo-Krome Screw Corp., Hartford 10, Conn.



Magnetic Clamping Device Holds Non-Magnetic Work

The "Magna-Vise" consists of a pair of magnetically actuated clamps that hold non-magnetic work parts against the face of a magnetic chuck for machining purposes. Each clamp is composed of two steel sections connected to each other by a pre-set steel strip. The angle of the spring is such that these sections normally will be 5° to each other. When the chuck is energized jaws are forced to a horizontal position by the magnet exerting lateral thrust against the workpiece.

Hanchett Magna-Lock Corp., P. O. Box 816, Big Rapids, Mich.



Two-Part Pallet Rack Constructed of Structural Channel

Simplicity is the keynote of this prefabricated pallet rack. It is constructed of two parts; an upright end member which can serve at either end or between sections, and the bed member. Beds are constructed with two channel cross members. All joints are welded including the face plate on the end of the beds. Holes can be positioned in the uprights to meet users' specifications for pallet load under-clearance. Dimensions and capacities can be varied according to customer's pallet sizes and load requirements.

Burke Bartlett Co. Inc., 708 Stephenson Bldg., Detroit 2, Mich.

Left—5 of the 55 pieces of luggage in the smart Samsonite line. All are now equipped with lustrous, solid brass fittings to make Samsonite Luggage look better longer.

Samsonite Luggage

SWITCHES TO SOLID BRASS FITTINGS . . . TO MAKE THE "WEAR SPOTS" ON ITS LUGGAGE STAY SMARTER LOOKING LONGER.

Revere Brass Strip selected for its unusually fine, uniform grain after hardware is formed.

● The name Samsonite has become synonymous with quality luggage the country over. It has a reputation to uphold. For that reason, when the brass plated fittings with which this luggage was initially equipped, started to tarnish and show signs of premature wear, the Samsonite people did a double-take. After consulting with their own engineers and the Revere Technical Advisory Service it was decided that nothing less than solid brass would be in keeping with so fine a line of luggage. Revere Brass Strip, because of its very fine uniform grain, was selected for the job.

Samsonite was extremely pleased with the results. They found that after the luggage hardware was formed it had just the lasting, lustrous quality they were looking for. A fitting companion for the smart Samsonite cases. Now, all external hardware and the internal fittings, where rusting would be detrimental, are of solid brass. Even the keys, usually stamped, are of solid brass, coined and milled.

Perhaps Revere Brass or some other Revere Metal can be of help in improving your product—cutting your production costs. Why not tell Revere's Technical Advisory Service about *your* metal problems? Call the Revere Sales Office nearest you today.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

• • •

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

toughen metal

improve surface

end stock waste

with

TORRINGTON SWAGERS

The Torrington Rotary Swaging Machine delivers 4000 hammer blows a minute...reduces, sizes, rounds, points and tapers rod, wire and tubing... work-hardens metal for toughness and resilience...produces a burnished surface... utilizes every bit of stock.

Torrington Swager performance is based on our 42 years of swaging experience. Send the coupon for your free copy of the booklet illustrating the machines and describing the art of rotary swaging.

THE TORRINGTON COMPANY
Swager Department
559 Field Street • Torrington, Conn.

For a free copy of this booklet, send the coupon today.

Please send a copy of "The Torrington Swaging Machine" to:

Name_____

Firm_____

Address_____

Chemical Surface Treatment Prepares Metals for Finishing

"Surprep" is a surface preparational material for cleaning aluminum, steel, and zinc surfaces prior to organic finishing. It is a liquid containing oil-displacing chemicals, said to quickly dislodge oil, grease and other organic materials. It contains phosphate and other chemicals that quickly dislodge rust, oxide, and scale, while the oil removal agents are operating. Application of Surprep is followed by quick rinsing with water or wiping with a cloth. It is supplied in one-gal jugs, 5- and 12-gal carboys, and 50-gal barrels.

Enthone, Inc., 442 Elm St., Dept. MHP., New Haven, Conn.

Drum Type Magnetic Separator Is Non-Electric Unit

Constructed for installation at the discharge end of chutes, spouts, and conveyors, the types FA and SA permanent-drum non-electric alnico magnetic separators are equipped with adjustable dual-purpose leveler and burden feed control. Complete with shaft and V-belt drive sheave, this unit for automatic tramp iron removal is of circumferential pole design which gives uniformity of magnetic field across the drum width. The non-magnetic material flows over the drum shell in a normal trajectory. The tramp iron, held fast to the

CROSS UNIVERSAL GEAR MACHINES

for

- ROUNDING
- CHAMFERING
- POINTING
- BURRING

Cross Universal Gear Machines embody advanced engineering developments to obtain highest productivity and assure lowest possible operating costs.

They feature utmost flexibility for handling a wide variety of gears. Continuous cutting motion, exclusive with Cross, speeds production at top efficiency.

Special skill is not required because machines are automatic and push button controlled. Power clamping is foot pedal controlled. Both hands are free for work handling.

No. 55

For rounding, pointing, chamfering or burring external and internal:

spur gears
helical gears
clutches
splines

Typical productivity when rounding or pointing 8 pitch 30 tooth gears is 55 net hourly.

No. 65

For pointing or chamfering external and internal:

clutches
spur gears
bevel gears
splines

Typical productivity when pointing 10 pitch 30 tooth gears is 100 net hourly.

No. 75

For burring or chamfering both ends at the same time.

helical gears
spiral bevel pinions
hypoid pinions

Typical productivity when chamfering 8 pitch 40 tooth gears is 200 net hourly.

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DETROIT 7, MICHIGAN

There's More than One Way to Bear Down on Costs

By James B. Scott, President
Welded Products Company, Grand Haven, Michigan

When the backfield runner hits the line and finds a stone wall, he tries to skirt around it for yardage. Likewise, many shops follow these tactics in the tussle for lower costs.

When we can make no further headway in cost reduction with an existing method, we often manage to find new, fresh approaches to the problem. For example:

1. Examine the design. To improve the cast sprocket for a chicken feeder, we used two stampings as shown in Fig. 1. The resultant sprocket operates better because the feed doesn't jam in the teeth. To get the same results with the former design would have cost considerably more.

2. Examine the set-up. We were nip and tuck with competition (another process) on a machine base. By devising an improved clamping and positioning fixture, we speeded up output from 5 bases to 9 bases per day —cut unit cost $2.20 each.

3. Examine the welding procedure. Types and sizes of electrodes . . . amperage . . . A.C. or D.C. . . . these factors are weighed in setting up the procedure for each job. On a recent cold-rolled steel job, we used "Shield-Arc LH-70" electrodes and eliminated pin-holes, speeding up welding and cutting costs.

In all of our efforts to bear down on costs, we find it extremely helpful to have the advice of the Lincoln Welding Engineer, and we use Lincoln Welders and Electrodes practically 100%.

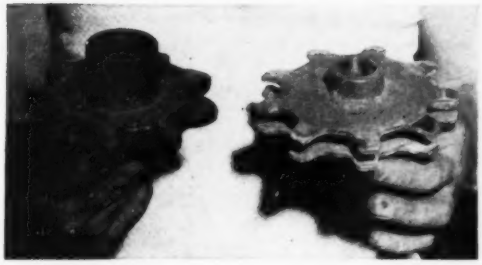


Fig. 1. Changeover of this chicken-feeder sprocket to welded stampings eliminated feed jamming.

Fig. 3. Typical of the welding output of Welded Products Company is this group of engine brackets, fabricated from stampings and shear-cut plate.

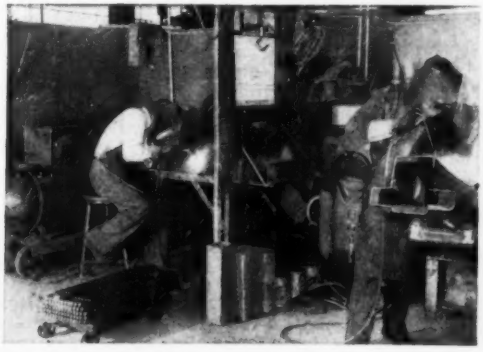
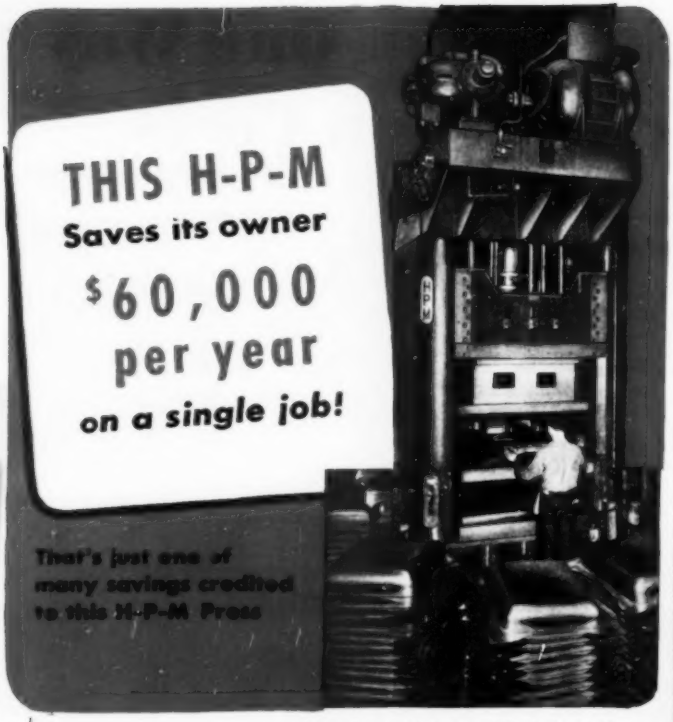


Fig. 2. Two points of attack on welding costs: Left—Duane Brady and James Scott work on the modification of a product design. Right—Ingenuity is applied to the design of fixtures and the planning of welding procedure for each product.

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*
Write for free Mild Steel Weldirectory, Bul. 462. The Lincoln Electric Company, Dept. 109, Cleveland 1, Ohio.



These drawn cabinet types—960 of them in 8 hours—for Lincoln's new "FLEET-ARC" welders also make a gasoline tank when welded together

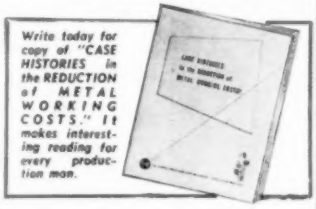
Increased output, higher quality performance, lower labor and maintenance costs—add them up and this H-P-M Fastraverse Press shows annual savings of $60,000 on one job alone for Lincoln Electric Company!

This is just one of the many jobs this versatile H-P-M Press performs. It forms heavy metal sections which replace castings. It coins parts that replace forgings—parts formerly purchased outside. As a result, many machining operations are eliminated, cutting Lincoln's costs and improving their competitive position.

For YOUR Protection

Take a tip from Lincoln Electric! Install H-P-Ms for deep-drawing, forging, die straightening, coining, forming and assembling operations. H-P-M presses are completely self-contained, all-hydraulic — easy to install, quick to set up, simple to operate, low on upkeep.

Ask an H-P-M engineer how you can save money with H-P-M presses, or write for the facts today.


Write today for copy of "CASE HISTORIES in the REDUCTION of METAL WORKING COSTS." It makes interesting reading for every production man.

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drum by the magnetic pull, drops off when it passes out of the magnetic field. No discharge aids are necessary.

Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wis.

Electronic Motor Control Maintains Constant Torque

Remote stepless speed adjustment and control for frictional horsepower motors are obtained with the Dyna-Speed electronic motor control unit. It consists of a rectifier cabinet and special dc ball-bearing motor, remote control dial box, and 10 ft of connecting cable. By setting speed control dial knob, speeds from 80 to 1800 rpm can be maintained substantially constant regardless of load change. The unit is available in ratings of ¼ to ½ hp.

The Brown-Brockmeyer Co., Dayton, Ohio

Fragile Parts Eliminated In Rotary Impact Wrench

Diametrically located impact anvils on the Cleco A-3 reversible pneumatic rotary impact wrench strike simultaneously, applying balanced power to the socket. Capacity is ⅜ in. bolt size. Springs and other fragile parts have been eliminated. The unit weighs 4 lb 8 oz, and is 6⅝ in. long.

Cleco Div., Reed Roller Bit Co., P.O. Box 2119, Houston 1, Texas

Spring Device Resistance Decreases with Deformation

Here is a spring device which is said to work in reverse. It resists less the more it is deformed. The secret of the Neg'ator lies in pre-stressing each successive increment of length of a flat strip of spring stock by a pre-determined (but not necessarily constant) amount. In its relaxed position, this strip forms into a tight

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For further details ask for Bulletin 910.

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coil. Manufacturers claim this device has enormous expandibility (up to 50 times any original dimension); ability to act around corners and through small openings; high initial force in resisting first increment of deflection; and the ability to store and deliver approximately twice as much energy as an ordinary spiral or power spring occupying the same space.

Hunter Spring Co., Lansdale, Pa.

Dip Process Brightens, Protects Aluminum Alloys

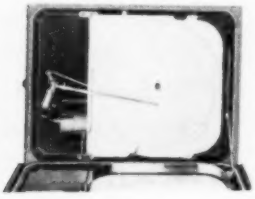
Mironizing is a dipping process for aluminum and aluminum alloys including those containing copper, that takes 5 min and is said to produce an excellent base for paints and lacquers. As-fabricated parts can often be put through this finishing sequence without prior polishing or buffing. Much work, depending upon the size and shape of the parts, can be handled in bulk, as in baskets. Corrosion resistance of this finish is said to be very high. No after lacquer is required. Chemical control is simple and a chemist is not needed.

Technical Processes Div. of Colonial Alloys Co., Philadelphia 29, Pa.

Paragon Assortment Includes 27 Die Springs

The Paragon S-27 die-spring assortment contains 27 surface-stressed die springs, 11 in. long over-all with plain ends to fit holes from 7/16 to 1 9/16 in. and to fit rods from ¼ to 15/16 in.

Paragon Spring Co., 3615 W. Fulton St., Chicago 24, Ill.



Pressure Gage Records Low Pressure Range

Employing a frictionless pressure-sealed lever arm, entirely free from lost motion and turning moments due to changes in differential pressure, the Series 500 recording absolute pressure gage records extremely low absolute pressure ranges. The instrument is offered in ranges of 0 to 20 mm. hg and up. It is said to give an accurate record of vacuum

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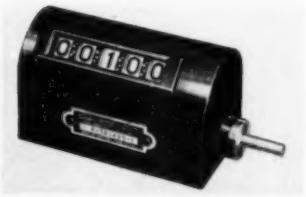
in terms of absolute pressure, and is offered as a recorder, an automatic controller, and for remote measurements and automatic control of absolute pressures.

The Bristol Co., Waterbury 91, Conn.



Dual Cam Counter Tallies 500 Per Min

This counter can be supplied as a revolutionary ratchet counter, adding one count per revolution of the drive shaft in either direction, or as a ratchet with stop counter (made to order only), adding one count for each oscillation of the lever through an angle of 30°. Maximum recommended speed for the former is 200 counts per min, and the latter 500 counts per min. Counter is reset by clock key.

Veeder-Root Inc., Hartford, Conn.

Plexiglas Lathe Shield Protects Lathe Operators

Attached by means of a spring clip to any cutting toolholder, this Plexiglas shield is 3 in. high by 5 in. wide and provides full vision of every cutting operation. Adjustable to any position, it deflects and concentrates chips and shavings, making it easy to clean the lathe. Spring clips are available for ¼, ⅜, and ½ in. cutting tool holders. Shield and spring clip combined is priced at $1.50.

Frank Gradischnig Co., 2417 No. Cramer, Milwaukee 11, Wis.

Magnetic Pipe Roll Eliminates Electrical Connections

Fabricated from permanent non-electric magnets, these magnetic rolls are for the "drag out" of pipes and shapes from galvanized pots. With

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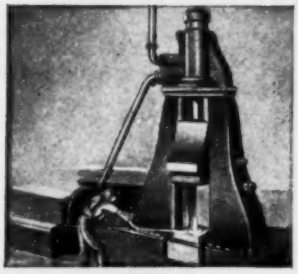
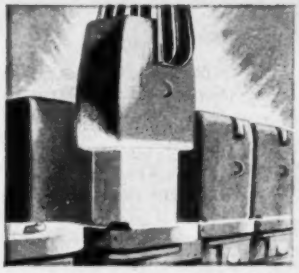
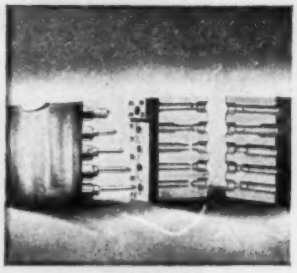


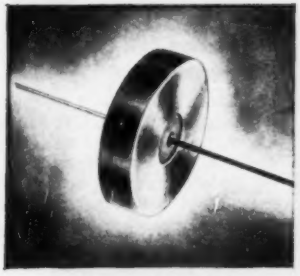
FORGING



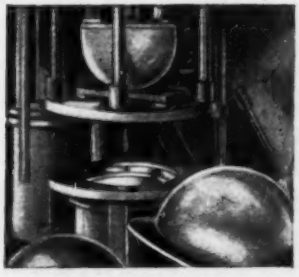
STEEL INGOT STRIPPING



DEEP PIERCING



WIRE DRAWING



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At high temperatures . . . 400°F. and up, where ordinary lubricants begin to fail . . . **"dag"** colloidal graphite dispersions lick friction and keep parts lubricated for action.

"dag" colloidal graphite is not just ordinary graphite. It is graphite which has been processed scientifically so that its particles are usually less than .000039 inch in diameter!

This means that when colloidal graphite is applied to the friction surfaces of metal it leaves a lubricating film so thin that even the most sensitive gages cannot detect it. The film is many times more durable than an oil film. It provides the metal with a graphoid surface that has an extremely low coefficent of friction, that resists oxidation, and that will function at temperatures far above the burning point of oil.

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Each of these economical grinders have a hydraulically controlled table with travel speeds up to 90 f.p.m. Wet grinding attachment and built-in wheel dresser are also available. Write for free illustrated Bulletin A-229.

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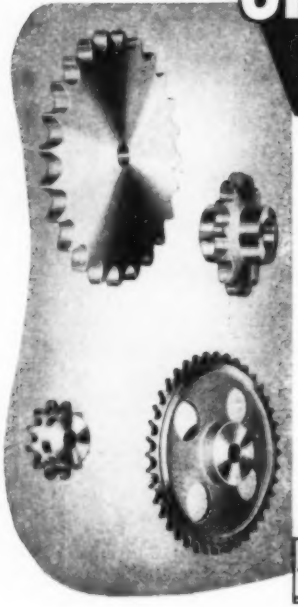

Send for the SEWALL CATALOG which lists all types of stock sprockets. Sewall roller chain sprockets are available for conveying and power transmission uses. We cut sprockets to order for any type of roller or silent chain. Large and small sizes . . . any material or quantity.

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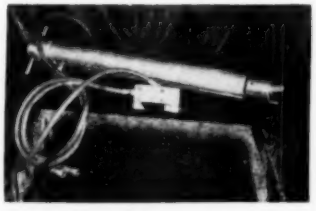
no electrical connections they withstand temperatures up to 800 F. Installed at the end of the galvanized pot, pipe, or shapes are placed in the contour of the roll and the galvanized material is magnetically guided through a steam or air blast where excess zinc is removed. Pipe ranging in size from ⅜ to 6 in. dia can be handled.

Eriez Mfg. Co., 772 E. 12th St., Erie, Pa.

Roll-Turning Tool Tip Mechanically Held

For use in longitudinal feed lathes, the Kennametal Style LRT roll-turning tool is intended to be set at an angle in the tool post to allow for the desired depth of cut. Solid Kennametal blade has four cutting edges that can be used in succession before sharpening is required.

Kennametal Inc., Latrobe, Pa.



CITCO Diamond Turner Is Hydraulic, Automatic

The Model 1001-A CITCO Hydraulic Diamond Turner, for Cincinnati centerless grinders, automatically repositions dressing diamonds by turning them three degrees. Installation of the turner takes 15 min, and it is guaranteed to give satisfactory service for one year.

Cleveland Industrial Tool Corp., 1080 E. 222nd St., Cleveland 17, Ohio.

Six Electrode Holders Added to GE Line

Manual electrode holders in 100, 200, 400, and 800 amp ratings, and machine welding electrode holders in ratings from 400 to 800 amps are available. The manual holders are: 100 amp air-cooled model with spring

Baker 4 Station Automatic Transfer Machine

Increases Production— Reduces Handling

For End Operations on Axle Housings

1 Flexibility provided for handling housings from 60" to 92" in length with bore diameters ranging from 1½" to 2 7/16".

2 Spindle ends carrying Coredrills at first station piloted through live bushings. Total depth of coredrilling divided into four passes.

3 Parts automatically clamped at each station by hydraulic pressure which turns screw that actuates jaws. Hydraulic pressure always on, assuring positive clamp at all times.

4 Housings raised on index rails and indexed to next station hydraulically. Automatic unloading.

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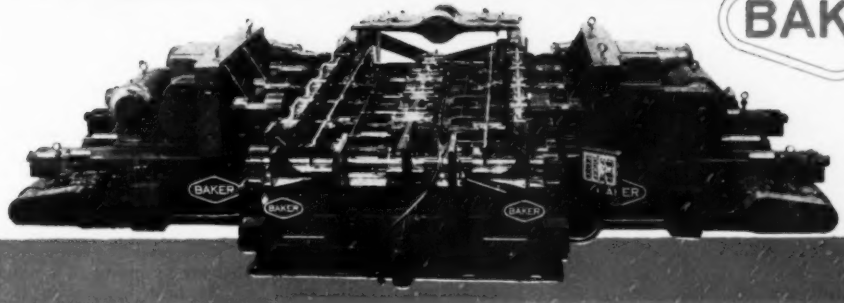

BAKER BROTHERS, Inc., Toledo, Ohio

Drilling, Tapping, Keyseating and Contour Grinding Machines

TORIT DUST COLLECTORS

win "converts" on this converted planer

Illustrated above is a special purpose grinder. A large farm tool company built it from an old planer, and to catch the dust, resulting from its operation, they used a Torit No. 75 Dust Collector equipped with a 4 inch flexible hose. The nozzle is permanently attached to the wheel guard. It moves with the grinding wheel and operates with practically 100% efficiency.

Torit Dust Collectors can be adapted for nearly every dust collecting job. Compact and efficient, they take up little room and, by recirculating the cleaned air, minimize heat losses.

For information and catalog showing the many types and sizes of Torit Dust Collectors available for immediate delivery, write:

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PRODUCTION UP... COSTS DOWN with... HOLE-HOG MACHINE TOOLS

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
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- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

"Hole-Hog" does it better with 50 years of Machine Tool Engineering experience at your service.

type collets, metal nozzle, and gas tight heat-resistant gaskets; 200 and 400-amp water-cooled models with split copper collets, ceramic nozzles, and gas-tight heat-resistant gaskets; a 400-amp model with integral water-cooled metal nozzle with tips of two orifice diameters; and an 800-amp model with one electrode assembly including water-cooled metal nozzle for each size, 5/16-, ⅜-, 7/16-, and ½-in. electrodes are available for the 800-amp model.

General Electric Co., Schenectady 5, N. Y.

Non-Repeat Device for Bench and Floor Presses

Adaptable to any press this non-repeat device acts as a secondary clutch. The downward action of the press ram releases it, allowing the upper portion of the treadle rod to disengage the primary clutch on the press flywheel. The operator must bring the treadle to the up position to reengage the clutch in the device.

Searjeant Metal Products, Inc., Dept. P-2, Box 101, Mendon, N. Y.

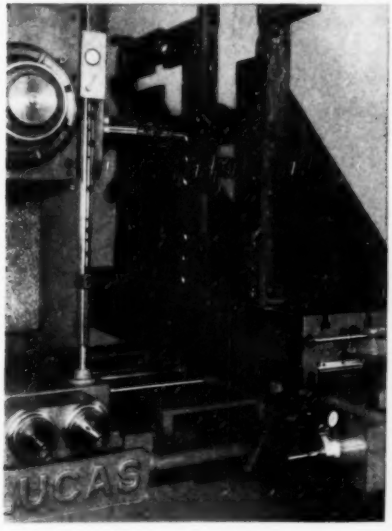
High Cost Cutter Blades Rolled in Low Cost Bodies

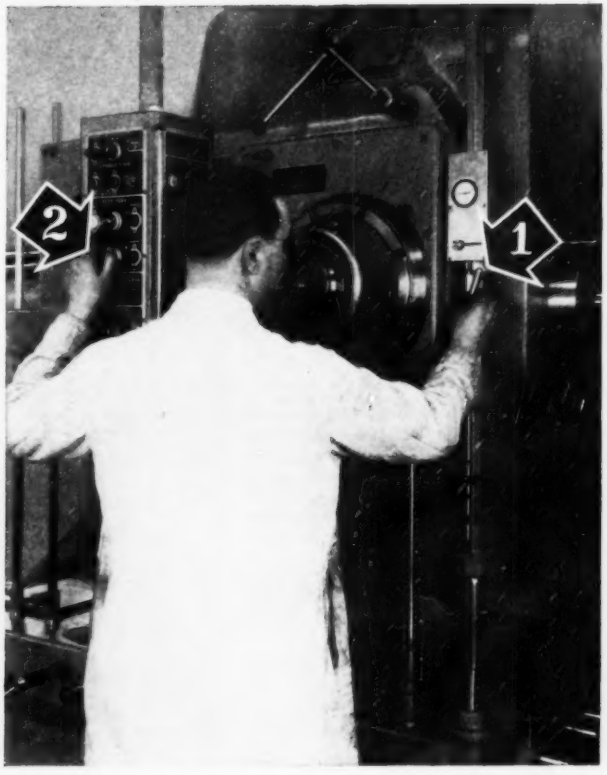
Available in standard sizes up to 6 in. dia these high-speed reamers consist of high cost cutter blades secured in recesses of a low-carbon steel tool body by means of a rolling process. No heat application is necessary.

• Power Indexing • Automatic Power Positioning
• Automatically Controlled Indexing • Push Button Indexing
Whatever YOU call it LUCAS HAS IT

Since we introduced the addition of power positioning to the use of end measuring rods twelve years ago, this Lucas feature has gone by different names in the plants of different customers — but all agree that it has revolutionized the usefulness of the horizontal boring machine, making it not only a versatile machine shop tool, but a highly accurate production machine.

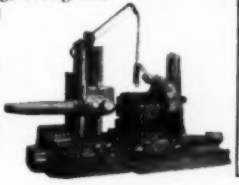
Here's how it works: First hole has been bored. At 1, (right) operator removes top rod of same length as distance to next operation. At 2, he pushes the head down feed and rapid traverse buttons on movable pendant. Spindle head feeds down and is automatically positioned when dial indicator contacts end of next rod. Automatic positioning of the table is controlled by other end measuring rods and dial indicator which operate exactly the same way.





By using a machined surface as a basic reference point the operator can automatically position the center line of the spindle to the center line of any operation with extreme accuracy, *without the use of jigs or fixtures.* On production work it will positively repeat a series of drilling, boring and milling operations on any required number of pieces.

Wherever they are in service, Lucas Precision boring, drilling and milling machines accomplish basic savings in both tools and time. Their versatility is so great that they are kept in practically constant use.



Built in 3", 4", 5" and 6" spindle models, all available with automatic power positioning. Work ranges from 36" x 36" to 96" x 120". All sizes furnished with either two-way or four-way beds, and feature high and low speed ranges to a single spindle. Write for descriptive literature.

LUCAS OF CLEVELAND

LUCAS
Precision

HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 8, OHIO

SLASH MELTING COSTS

JOHNSON No. 1019 SOFT METAL FURNACE

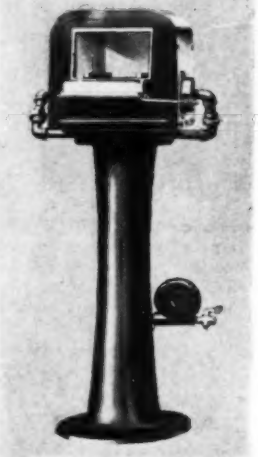
$312.00 F. O. B. FACTORY

for heavy-duty melting • Save time and gas in melting large quantities of lead, tin, zinc, pot metal, type metal, aluminum, etc. Nine powerful Johnson direct jet burners deliver pot temperatures up to 1400° F. for fast melting. Assures quick recovery after reloading. Each burner has separate shut-off valve and pilot light permitting use of only as many burners as needed to maintain melting temperature. Heavily insulated to reduce heat loss. Complete with removable cast iron pot and lifting hooks.

SPECIFICATIONS
Height—30". Diameter—30".
Capacity—1000 lbs. lead.
Pot—19" diam. x 10" deep.
B.T.U. Input—234,000 per hour.
Shipping Weight—600 lbs.

Quick Acting
JOHNSON No. 120 HEAT TREATING FURNACE

- 1500° F. in 5 minutes
- 2300° F. in 30 minutes



Quick Acting JOHNSON No. 120 is unexcelled for heat treating high speed steels, for hardening any steel tools, dies, or small metal parts. Ideal for brazing carbide tipped tools. Gets the job done quick to save time and gas. Easily regulated with accuracy. Firebox 5 x 7¾ x 13½ lined with high temperature insulating refractory. Complete with Carbofrax Hearth, G. E. Motor, and Johnson Blower.

$145.50 F. O. B. FACTORY

JOHNSON GAS APPLIANCE CO.
589 E Avenue N. W., Cedar Rapids, Iowa

COMPLETE JOHNSON CATALOG . . . Write for FREE Catalog describing all time saving, cost cutting JOHNSON Furnaces for pot hardening, melting, annealing and heat treating purposes

Worn and undersized reamers can be rerolled and sharpened at the factory.

Hasley Products Co., 29706 Grand River Ave., Farmington, Mich.

Electric Tool Has Both Rotary, Reciprocating Action

Sawing, drilling, filing, honing, sanding, embossing, burring, and grinding are some of the uses for this Sheldon Products Co., all-purpose electric tool. It has both rotary and reciprocating action controlled by a single selector. Weighing 6 lb., 8 oz. it can be operated either as a portable tool or on horizontal or vertical bench stands. It saws metal or wood and has a 7/16-in. stroke at 2000 per min.

Sheldon Products Co., 3301 Broadway Ave., Cleveland, Ohio.

Elgin Diamond Compound for Lapping, Polishing Operations

Elgin "Dymo" diamond compound is available in the complete range of Bureau of Standards Abrasive Grades and is said to have high resistance to caking or drying out. It is also said to maintain stability at temperatures as high as 150 F. Each grade is readily identified by means of a color system.

Industrial Products Div., Elgin National Watch Co., Aurora, Ill.

Snap Gage Equipped With Dial Indicator

The Federal Model 1000 dial indicator snap gage is offered in five sizes covering all dimensions from 0 to 6 in. The dial indicator has cushion movement and can be faced

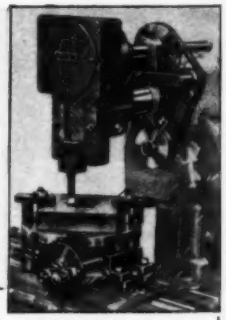
NEW

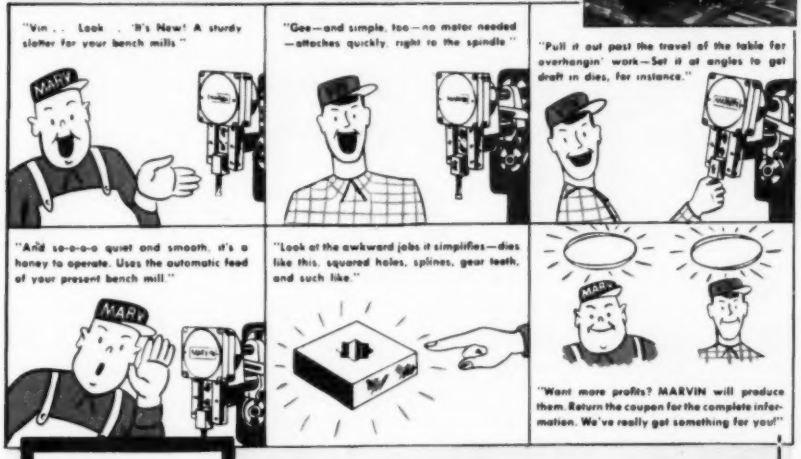
Increase the Versatility of Your Bench Mills

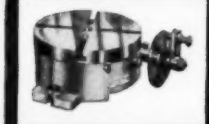
400%

with the

MARVIN SLOTTING ATTACHMENT AND ROTARY TABLE




"Vim . . Look . 'It's New! A sturdy slotter for your bench mills."
"Gee—and simple, too—no motor needed—attaches quickly, right to the spindle."
"Pull it out past the travel of the table for overhangin' work—Set it at angles to get draft in dies, for instance."
"And so-o-o-o quiet and smooth, it's a honey to operate. Uses the automatic feed of your present bench mill."
"Look at the awkward jobs it simplifies—dies like this, squared holes, splines, gear teeth, and such like."
"Want more profits? MARVIN will produce them. Return the coupon for the complete information. We've really got something for you!"



Add this MARVIN Rotary Index Table to your Slotting Attachment for maximum versatility. This 6" table cannot be matched for price—extremely rigid, furnished with index plates and hand wheel.

MARVIN R-1102 ROTARY TABLE $93.00 F.O.B. Factory

This MARVIN Slotting Attachment makes your bench mill capable of a wider range of work than you thought possible—gives you an extra machine tool, (quick job change-overs), without a big investment. Mail the coupon today for literature and prices on the full MARVIN line of Bench Mill Attachments, including Vertical Mill Attachment and Rotary Table.

MARVIN S-1070 SLOTTING ATTACHMENT $82.00 F.O.B. FACTORY

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FACTORY—CANTON, OHIO

MARVIN MACHINE PRODUCTS, INC.
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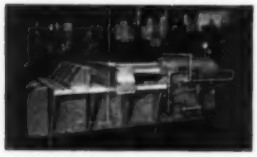
BEATTY combination Press Brake & Flanger does flanging, V-bending, pressing, forming, straightening.

BEATTY CoPunShear, one unit does coping, punching, shearing.

BEATTY Hydraulic Vertical Bulldozer for heavy forming and pressing.



BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.

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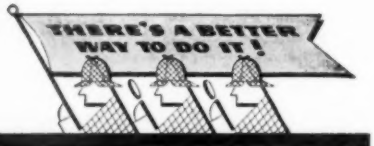
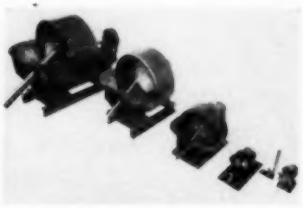
BEATTY-*engineered* heavy metal working equipment is on the job in hundreds of important plants, doing a wide variety of jobs. Yet, each machine is individually engineered to do its specific task better, faster, at less cost. This wide range of experience is your assurance of expert counsel, advanced engineering, finest quality construction. There's a better way to handle any heavy metal fabricating problem. Our job is to help you find that better way. If you have a problem, write us. We may have the answer.



BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

in any position for machine or bench use. A guard protects it from abusive treatment. The contact point is spring mounted and guarded from sideways blows. Upper and lower contacts are tungsten carbide tipped. A bench stand is also available with the unit.

Federal Products Corp., 1144 Eddy St., Providence 1, R.I.



Kraus Hoppers Made for Specific Feed Jobs

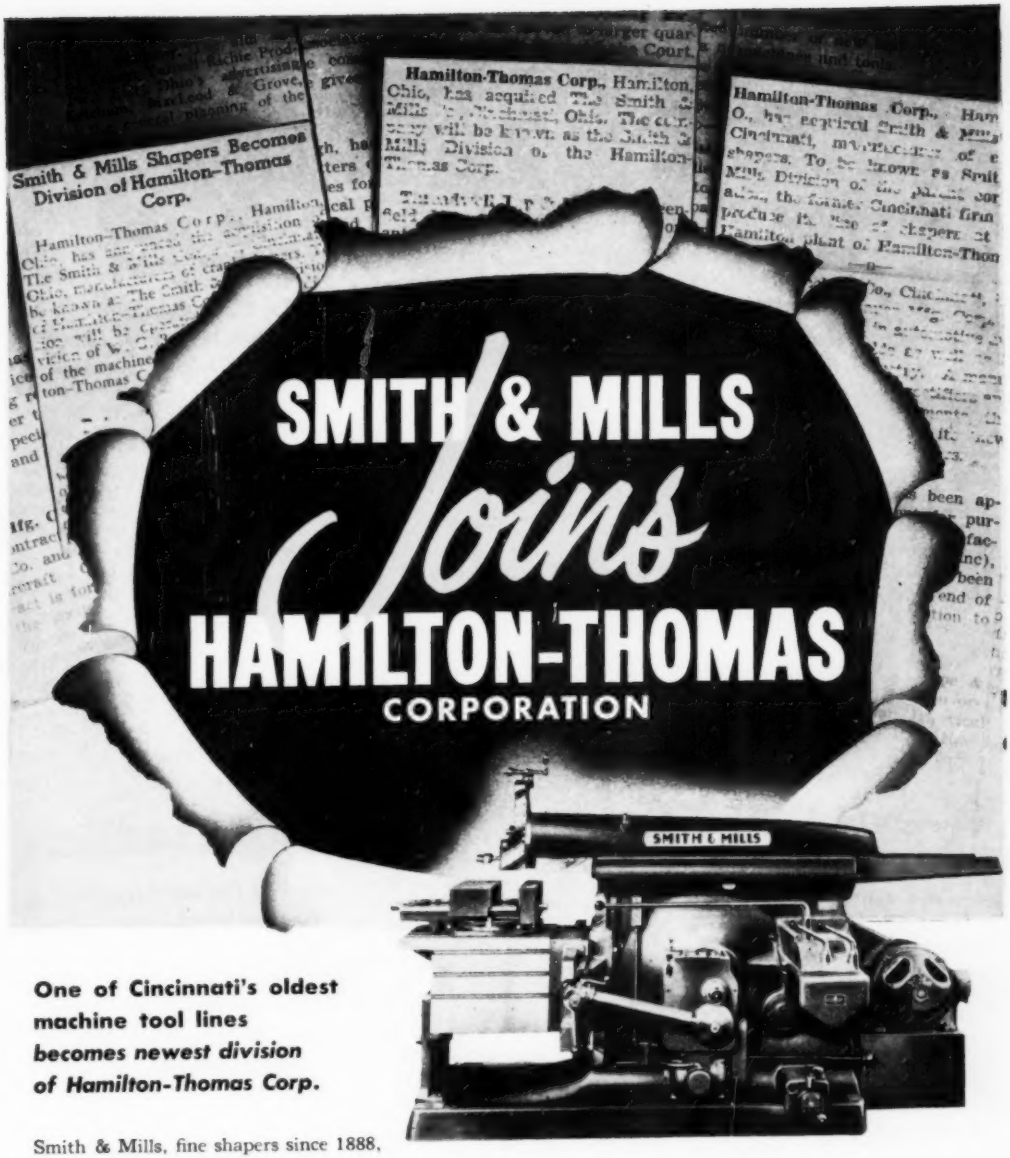
Each of these five Kraus Hoppers was designed for specific purpose. They feed oriented parts into nests for special assembly machines where assembly is automatically completed and the combined parts ejected. These units range from a 4-in. model (at right) to 32-in. model.

Kraus Design Inc., 41 S. Water St., Rochester, N.Y.

Consecutive Numbering Machine Is Solenoid-Operated

The Acromark solenoid numbering machine applies an inked consecutive number at each actuation of the solenoid without interfering with the continual movement of the tape or strip being marked. The unit is encased in a sheet metal housing with no adjustments necessary except for thickness of tape.

The Acromark Co., 7-13 Morrell St., Elizabeth 4, N. J.



One of Cincinnati's oldest machine tool lines *becomes newest division of Hamilton-Thomas Corp.*

Smith & Mills, fine shapers since 1888, are now part of a new, progressive company, Hamilton-Thomas Corp., makers of Liberty Planers, Economy Pumps and Klipfel Valves. Smith & Mills is a welcome addition to a company that's been tool minded since its foundation . . . and has the facilities plus the engineering know-how to keep Smith & Mills Shapers among the first names in machine tools.

Do you have the latest Smith & Mills catalog in your file? Write Dept. AM-10 for your copy.

SMITH & MILLS SHAPERS, INC.
Division of Hamilton-Thomas Corp.
HAMILTON, OHIO

"BUS-BOYS"..keep things moving.. but it's costly handling service in your plant

KEEPING things moving on production, assembly, processing or packaging lines can be done better, faster, and cheaper *mechanically* than manually.

Manual handling is held to a minimum—safety increased—operations coordinated — storage simplified — in modern plants equipped with Standard Conveyors.

Conveyors of versatility and flexibility—for movement of light or heavy commodities — in manufacturing plants, warehouses, stores — are part of Standard's long experience record in conveyor engineering and building. Whether you need only a light, easy to carry length of conveyor — a portable, self-contained conveyor unit—or a complete engineered system—call on Standard for service.

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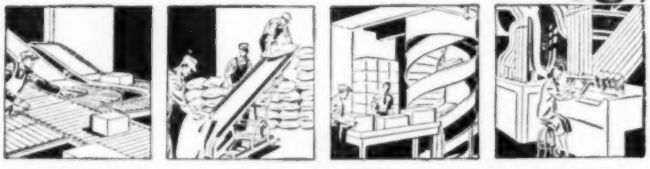
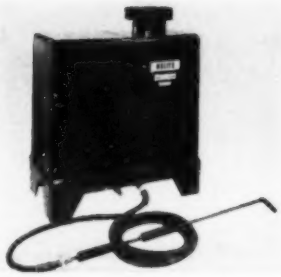


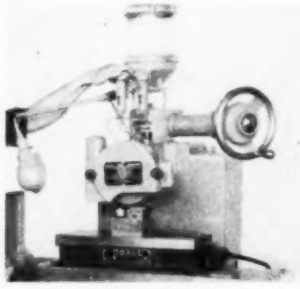
ROLLER - BELT - SLAT - CHAIN CONVEYORS • PORTABLE CONVEYORS AND PILERS • SPIRAL CHUTES • PNEUMATIC TUBE SYSTEMS



Kelite Steam Cleaner Vaporizes 110-Gal. Per Hour

Of all steel welded construction, the Model Q steam cleaner weighs only 465 lb and vaporizes 110 gal. of solution per hr. It is equipped with an automatic pump, automatic fuel regulator, automatic safety shut-off, high velocity nozzle, and aerated gun grips. This model is priced at $398.00.

Kelite Products, Inc., Box 2917, Terminal Annex, Los Angeles 54, Calif.



Coolant Applied Through Grinding Wheel Pores

On DoAll Precision Surface Grinders, coolant is injected into the pores of the grinding wheel, and leaves the wheel in the form of a mist at the point of work. This system is said to assure complete control of heat generated in grinding and prevents the grinding wheel from clogging. Its use has permitted rapid grinding of such materials as tungsten carbide and glass.

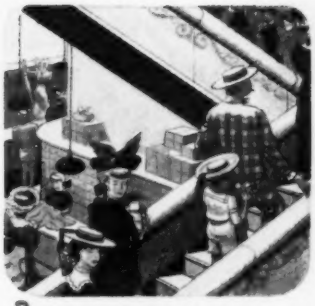
The DoAll Company, Des Plaines, Ill.

Heat-Transfer Fluids are Sludge Resistant

Made from Polyalkylene Glycols and derivatives, the UCON heat transfer fluids are reported to be most valuable in a temperature range from 60 to 500 F. Characterizeld by low pour points and little change in viscosity with temperature, they are said to have minimum effect on various

1 **1800**—For centuries, steps were man's main means of going up. First came the ladder; later, crude steps formed stairways. Even so, man still had to ascend a step at a time under his own power.

2 **1875**—Stairways took all forms—straight, spiral, plain and ornate. Then, one Samuel Gray patented an "elevator and moving stairway." Though impractical, his idea set others to work.



3 **1901**—The forerunner of today's moving stairs was installed in a New York store. By 1915, Howell "Red Band" Electric Motors arrived. Soon, these rugged motors were widely applied.

SAVED...20 MILLION STEPS A DAY!

4 **Today**—Modern, electrically driven moving stairs like this handle up to 8000 persons an hour . . . and save 20 million steps a day!

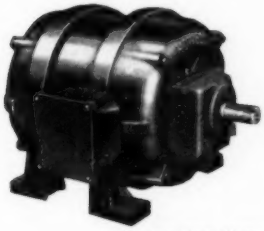
Howell is proud to have supplied the motors for many of today's outstanding moving stair applications. You'll also find Howell Motors on elevators, cranes, hoists, conveyors, fans, pumps and other important industrial equipment.

Howell's firsthand experience in the design, manufacture, and application of precision-built, industrial type motors can prove invaluable to you.

Consult Howell before you buy your next electric motor.

EQUIPMENT COURTESY HOUGHTON ELEVATOR CO.

Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.



Elevator Type Motor

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built Industrial Motors Since 1915

HOWELL Red Band MOTORS

AVOID COSTLY DELAYS AT THE TOOL CRIB

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Tool crib waiting time and overhead on idle machines add thousands of dollars monthly to production costs. It happens in other plants and may be happening in yours today.

"How Tool Costs Were Cut 12 Ways in 20 Plants" reports how manufacturers large and small have eliminated such delays with McCaskey Control. Reports of other big savings are told in the words of responsible plant executives . . . results and how they have been secured. They all add up to substantially lower tool expense and improved operating efficiency.

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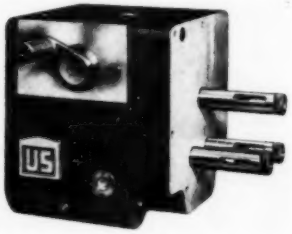
types of rubber and packings as well as unusual resistance to sludging and coking. Both water-soluble and water-insoluble fluids are available in various viscosities.

For high-temperature applications the water-soluble UCON 50-HB-280-X heat-transfer fluid with viscosity of 280 Saybolt Universal seconds at 100 F. is recommended. For a high temperature water insoluble heat transfer medium, UCON LB-300-X fluid is suggested.

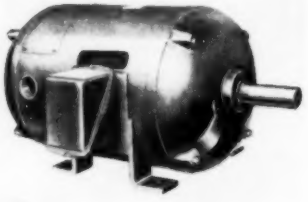
Carbide and Carbon Chemical Corp., 30 E. 42nd St., New York 17, N. Y.



Multiple-Spindle Drill Head Affords Variety of Speeds

Built to give machining of different materials correct peripheral speed on drills, taps, and reamers from a single speed drive unit, this multiple spindle drill head is oil lubricated and has a maximum recommended speed of 15,000 rpm. Gears of helical type with small helix angle to keep thrust at a minimum. Spindle speed is changed by means of specially designed sliding gears. The head can be built with any number of spindles to cover any area and can accommodate any kind of mounting.

U. S. Drill Head Co., Cincinnati 1, Ohio



Wound Rotor Electric Motors Installed on Drip Proof Frames

Crocker-Wheeler protected wound-round motors are for applications requiring smooth acceleration, high starting torque with low-starting current, ability to start and stop or reverse frequently, or variable speed

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of Mueller Brass Co.

RED TIP* ROD

is the secret ingredient that keeps your manufacturing costs low!

We manufacture millions of pounds of brass rod each month. Shipment can be made at once from our large factory stocks.

The constant UNIFORMITY of Mueller Brass Co. Rod saves tools, grinding, and "down" time. Brass Rod users throughout the United States and abroad know this and they continue to use it year after year. THEY ARE ACTUALLY PINNING MORE PROFIT TO THEIR COST SHEETS.

Do you need a many-purpose Brass Rod or — a Brass Rod for one special purpose? Mueller Brass Co. Red Tip Brass Rod is a rod of a thousand uses. You can use it for almost any purpose and it is exceptionally free-cutting and consistently uniform.

The chemical composition, structure, temper and mechanical properties of Mueller Brass Co. Red Tip Brass Rod are so closely controlled that no perceptible variation in machinability can be noted from one batch of rod to another.

If you want brass rod for some special purpose, such as knurling, deep drilling, thread forming, or for bending, expanding or flaring, we make that, too, and we invite your inquiries.

Do you want more efficient production or better performance? Is a special alloy the answer? If you have a problem, tell us about it. Our Technical Engineers and Laboratory are at your disposal.

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Port Huron, Michigan

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Machine Anchoring
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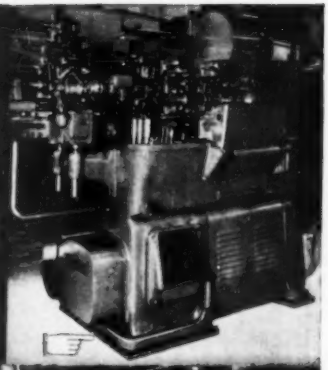

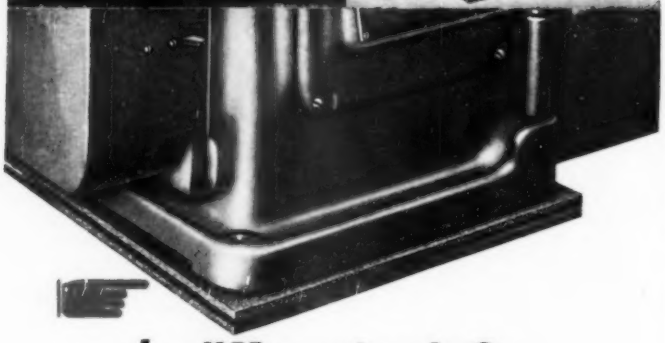

by "Mounting It On
UNISORB"

This leading clock manufacturer cut installation time materially when UNISORB machine mounting came into the picture.

They cut transmitted machine vibration 60% to 85%.

They eliminated the need for old-fashioned, destructive floor-drilling in most instances—*because UNISORB requires no bolts or lag screws.*

Your company can do the same. Clip and mail coupon *today.*

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MAIL COUPON FOR FREE BOOKLET TODAY!

Gentlemen: Please send my free copy of "Why It Pays to Anchor Your Machinery with UNISORB." ( )

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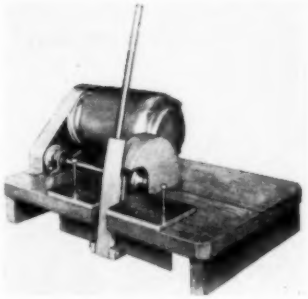
application. The motors are built in NEMA frames, 225-505 ratings up to 100 hp and in larger frames up to 2000 hp. Frame and end shields are drip proof. Special windings are available for crane and hoist service.

The Crocker-Wheeler Electric Mfg. Co., Div., of Joshua Hendy Corp., Ampere, N. J.

Emulsion Degreasing Agent Non-Irritating to Skin

Intended for use in standard cleaning equipment for removing grease from metal parts, Mulsolv degreasing agent is non-toxic and non-irritating to skin or nasal passages. Manufacturers say it leaves no scum and results in negligible corrosion of the clean parts. Sold in 50-gal. drums, it is mixed with 300 parts water to make degreasing solution recommended for general use.

Bee Chemical Co., 13799 S. Avenue O, Chicago 33, Ill.



Aeroquip Machine Cuts Flexible Hose Up to 3 in. OD

Small enough to mount on an ordinary shop bench the Aeroquip hose cutoff machine can cut all types of flexible hose including that reinforced with plies of wire braid. It will accommodate sizes up to 3-in. OD. No coolant is required for the cutting wheel and all moving parts are guarded.

Aeroquip Corp., Jackson, Mich.

Acid Cleaning Solvent Conditions Metal Surfaces

Oakite compound No. 33 was developed to remove rust, oxides, grease, oils, and shop soils from metal surfaces and to prepare ferrous metals and aluminum for sure-grip adhesion of paint, lacquer, and enamel finishes. It possesses detergents and solvent properties and is a pre-paint cleaning material for large steel or

Does your cutting oil give results like these?

$351.60 saved in coolant alone—in 40 days . . . and better machining!

This farm implement parts manufacturer formerly used a straight cutting oil in an automatic (49c per gal.) and a regular lubricating oil in the reservoir.

Now he uses ANTISEP ALL-PURPOSE BASE, (1-15 with water), both as a coolant and lubricant. No rusting or bearing wear, no skin trouble, no parts too hot to handle.

And real money saved—$351.60 in 40 days on one machine, plus the saving in lubricating oil. Nine months' run has proved the practical value of this change.

Production upped 15% . . . and tool life increased 50%!

The above threaded screws are brighter; tool life has increased 50% on chasers, 100% on forming tools; speeds increased to enable 15% greater production.

That's the experience of a clamp manufacturer using ANTISEP A. P. BASE, 1 to 25 water dilution.

And that can be your experience when you try this new concept in cutting coolants, which can handle 90% of your machining operations. May we prove it? Write E. F. Houghton & Co., Philadelphia 33, Pa.

HOUGHTON'S

ANTISEP

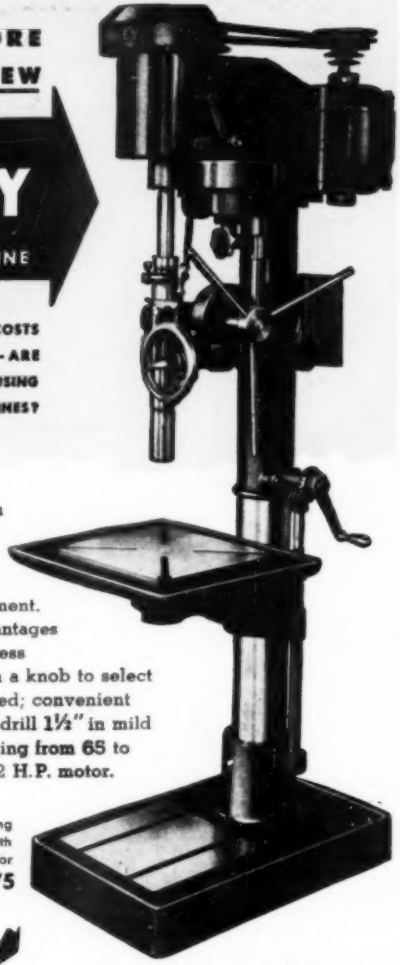
All-Purpose

CUTTING BASE

Take high cost labor off obsolete machines

PRODUCE MORE WITH THE NEW

SIBLEY
MODEL C-20
20" DRILLING MACHINE



10 YEARS AGO LABOR COSTS WERE 1/2 OF TODAY'S—ARE YOUR MACHINISTS NOW USING THE SAME DRILLING MACHINES?

Install a new model C-20 in your plant and make a comparison with production obtained from your present drilling equipment. It will demonstrate the advantages of such features as easy access to controls—where you turn a knob to select the proper geared power feed; convenient shifting of V-belt; power to drill 1½" in mild steel; 8 spindle speeds ranging from 65 to 1360 R.P.M. powered by a 2 H.P. motor.

Model C-20 Sibley 20" swing drilling machine complete as illustrated with 2 H.P., 3 Phase, 60 Cycle, A.C. motor and magnetic type starting switch **$919.75**
F. O. B. South Bend, Indiana

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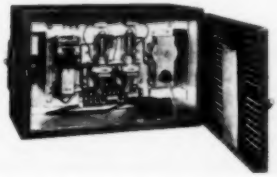
aluminum parts and sheets. Dilute solutions are applied at room temperatures by brush or cloth and allowed to soak on the surface briefly before rinsing and wiping. Medium-sized or small parts can be washed with this compound at temperatures approximately 140 F in tanks or acid-resistance washing machines. Water rinsing and quick drying complete the cleaning-conditioning cycle.

Oakite Products Inc., 124 Thames St., New York 6, N.Y.



Soldered Connections Eliminated In Welder Heat Controls

Class 8990 heat controls provide stepless adjustment of welding current from 20 to 100% on 440 volt systems, or from 40 to 100% on 220 volt systems. Available in separate inclosures for spot and projection welders, these units have no soldered connections, and only screw driver and pliers are need to replace components.

Square D Co., 4041 N. Richard St., Milwaukee 12, Wis.

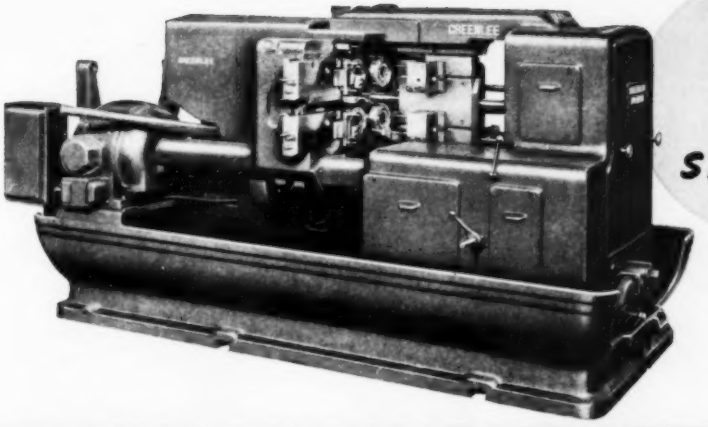
Pennsalt Solution Cleans Zinc-Base Die Castings

Pennsalt Cleaner Z-54 is composed of anhydrous alkaline ingredients and a combination of synergistic surface active agents. It is for reverse-current cleaning of zinc-base die castings prior to electroplating. Recommended concentration is 5 oz to the gal. with cleaning at solution temperatures between 180 and 190 F.

Pennsalt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

A.C.-D.C. Electrode Welds To 120,000 Psi Tensile Strength

All-State No. 299 ac-dc electrode is especially recommended for welding of vanadium-moly spring steels, nickel-clad steels, medium-carbon steels and air-hardenable steels. Said to combine good resistance to corrosion with tensile strength of 110,000 to 120,000 psi, this electrode is reported to have turned in an excellent performance on high chromium



4 SPINDLE

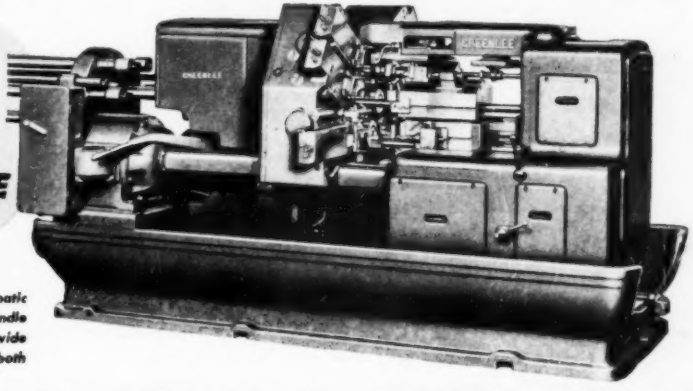
THE GREENLEE "FOUR"

A heavy-duty automatic made in 1⅝" and 2¼" spindle capacities. The "Four" incorporates all the cost-cutting features of the well-known "Six" (see below).

GREENLEE

AUTOMATIC SCREW MACHINES

6 SPINDLE



THE GREENLEE "SIX"

A ruggedly-built, high-speed automatic . . . available in 1", 1⅝", and 2" spindle capacities . . . capable of handling a wide range of work . . . widely used on both short and long-run jobs.

OUTSTANDING FEATURES OF ALL GREENLEE AUTOMATICS

Write for literature describing in detail all the features of Greenlee Automatics.

PRODUCTION MACHINERY

GREENLEE

UNIVERSAL TOOLING — Tool holders fit any cross-slide cavity . . . are easily and quickly changed . . . reduce equipment costs.

INTERCHANGEABLE CAMS — Can be changed at will without re-adjustment of tools and holders. Cam storage is held to a minimum . . . cam costs greatly reduced.

BUILT-IN THREADING DRIVE AND FEED — Not an extra attachment, but standard equipment on Greenlee Automatics.

BUILT-IN COOLANT SYSTEM — Eliminates cumbersome piping in tooling area . . . gets coolant right where it does the most good.

LARGE TOOLING AREA — Permits using many timesaving, cost-cutting auxiliaries that often eliminate second operations.

Various special adaptions of standard Greenlee Automatics can be made . . . for handling second-operation work . . . for tooling extra-long work pieces . . . for multiple feed-out arrangements, etc.

Send us details of your work. Let our engineers show you how profitably Greenlee Automatics can be applied to your production.

GREENLEE BROS. & CO., 1731 Mason Ave., Rockford, Ill.

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

pays for itself in 10 months

on parts for Westinghouse Laundromat

SAVES $25 per day on a single shift.

A Reed Cylindrical Die Thread Roller installed at the Westinghouse Electric Corporation plant in Mansfield, Ohio, for rolling oil grooves and threads on parts for the "Laundromat," is making total savings up to $25 per day for the first job set-up. With this saving the equipment will pay for itself in ten months. The parts are rolled as a secondary operation, stepping up the production of six spindle automatics 225%.

The thread rolling process maintains uniformity of size with ease and, with superior rolled threads, the Spinner Tub Shafts have a much greater fatigue strength.

Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

Manufacturers of

THREAD ROLLING MACHINES AND DIES • KNURLS • THREAD ROLLS

Worcester 2, Massachusetts, U.S.A.

AM 1114

nickel steels as well as tool and die steels. Its applications include work on high specification jobs such as pressure vessels, jet propulsion equipment, tools, and dies.

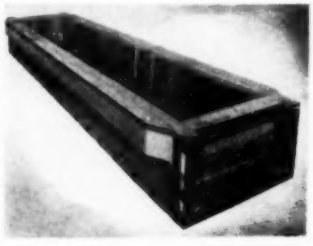
Preheating the base metal to a temperature of 300 to 500 F. is good practice. The deposited metal cannot be heat-treated.

All-State Welding Alloys Co. Inc., 273 Ferris Ave., White Plains, N.Y.

Heavy Duty Precision Switch Is Pedal Actuated

Containing a single pole double-throw circuit, the Micro Switch heavy-duty splash-proof precision switch is especially advantageous on equipment where operator safety demands two-hand control switches. Switch housing has a gasketed cover plate and a closely fitted actuator shaft which protects the inclosed unit from dust, dirt and the splash of oil, water or coolant. Electrical rating is 15 amps, 125, 250, or 460 volts ac.

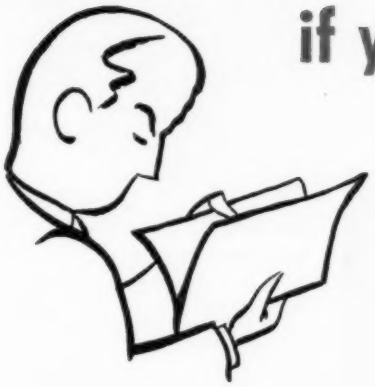
Micro Switch, Freeport, Ill.



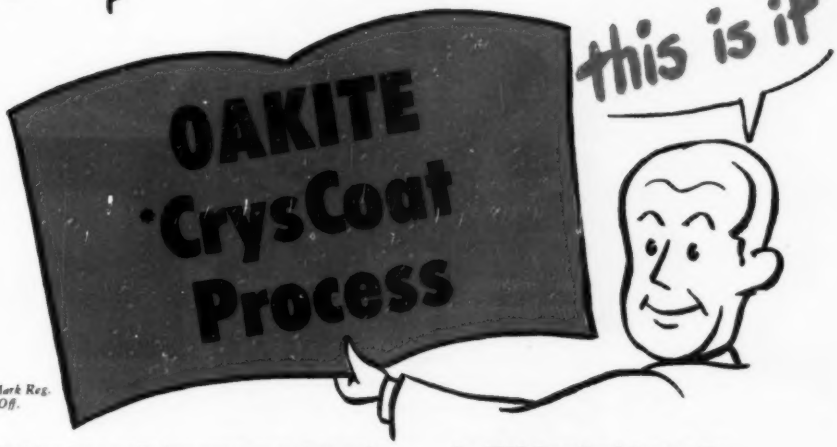
Metal Tubing Cleaned In Long Wooden Vats

Tubing in lengths up to 22 ft is lowered into this vat on an angle by a crane. Air or steam is forced through the tubing to effect proper cleaning. When not involved in cleaning operations, the vat can be used for pickling. Inside dimensions are 26 ft x 4½ ft, by 27 in. Resistance of wood to the actions of acid and chemical makes it specially practical for this work.

Wendnagel & Co., 600 W. Cermak Road, Chicago 16, Ill.



if you're looking for a LOW-COST way to prepare metal surfaces for painting



*Trade Mark Reg. U. S. Pat. Off.

If you are looking for a really low-cost way to clean and condition ferrous and non-ferrous metals before applying paint or other organic finishes—HOLD ON TO THIS PAGE! It describes the OAKITE CrysCoat PROCESS, scientifically designed for use in pressure-spray washing machines consisting of two (or more) stages. Designed, too, for use in agitated soak-tanks for treating zinc die castings before painting.

The OAKITE CrysCoat PROCESS prepares surfaces for painting at amazingly *low cost per 1000 square foot.* It (1) removes light soils; leaves your surfaces uniformly clean: (2) develops on metal an inert, microscopically thin phosphate base-film that anchors paint to metal and localizes under-paint corrosion: (3) prevents rusting between cleaning and painting procedures.

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PRECISION
SMALL GEAR
HOBBER

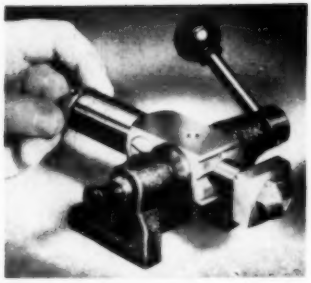
HOBS BEVEL GEARS
SPUR,
SPIRAL
and WORM GEARS

The Hamilton No. 1 Gear Hobber is built to extra close tolerances for the generation of *precision gears*. And because of its super-rigid construction it will *maintain* its precision under heavy production loads.

Speed, feed, and indexing can each be set independently of the others. This feature, plus the wide range of hob spindle speeds (109 to 1259 R.P.M.), provides the machine with great versatility, permitting easy adjustment of speed and feed to the requirements of the material being worked or specifications of the gear being hobbed. It also cuts set-up time far below previously acknowledged minimums.

The Hamilton No. 1 will add greatly to your production, and will deliver the precision-performance of a new machine year after year. It is the ideal machine for shops where set-ups are frequent, as well as for shops where runs are long. It is fully illustrated and explained in our Bulletin H 1-49, which is yours for the asking.

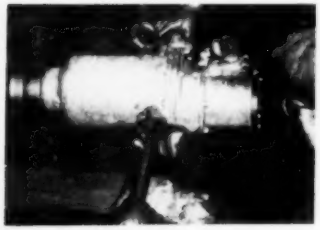
THE *Hamilton* TOOL COMPANY
SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTILATORS
830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A



Two-Unit Micro-Vise Holds Small Parts

Consisting of two units, a vise and a base fixture, the micro-vise is a precision tool for holding small parts. Jaw width is $1\frac{1}{8}$ in. and maximum opening of jaws is $1\frac{1}{4}$ in. The holding fixture enables setting the central shaft vise at either a horizontal or vertical position.

Metal Items, Racine, Wis.



Air Impact Tool for Heavy Bolting Up

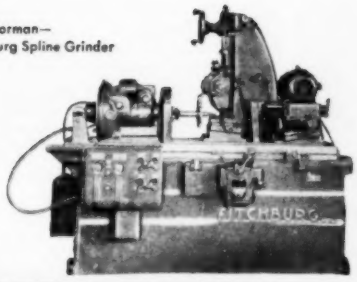
The Slugger Size 588 impact tool is designed for speedy repair of heavy equipment and for the manufacture of all types of machinery involving large studs, bolts and nuts. It is rated up to 4-in. bolt size. The tool weighs 215 lb and has a free speed of 355 rpm with 515 impacts per min. Overall length to shoulder of anvil is $26\frac{5}{8}$ in. and side to center distance on the hammer case is 4 in.

Ingersoll-Rand Co., 11 Broadway, New York, N. Y.

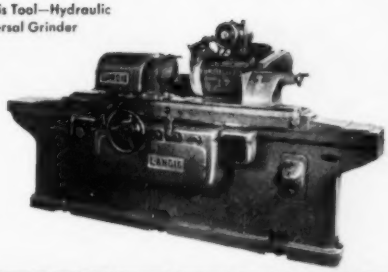
Plastic Coating Eliminates Several Metal Plating Steps

Krylon plastic coating is said to reduce the number of processes required to prevent rust and corrosion on metal stampings such as camera and radio parts. Coating engineers claim that several plating steps and the oil dip treatment can be eliminated by use of this transparent endurable plastic. Non-inflammable Krylon coating has the effect of a

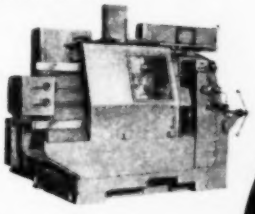
Van Norman—
Fitchburg Spline Grinder



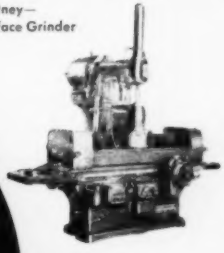
Landis Tool—Hydraulic
Universal Grinder



Bullard—
Man-Au-Trol Horizontal Lathe

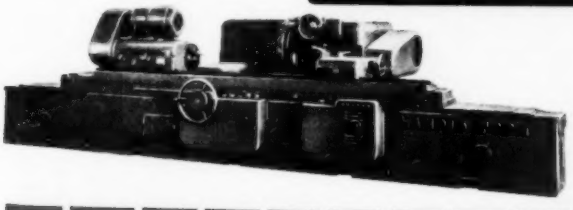


Pratt & Whitney—
Vertical Surface Grinder

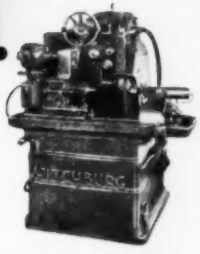


Your New Equipment Deserves Only The Best Lubrication

Landis Tool—
Hydraulic Cylindrical Grinder



Van Norman—
Fitchburg Special
Plunge-Cut Grinder



Get Skilled Cities Service Lubrication From the Start

More than *14 billions* of *dollars* will be spent on new plants and new equipment in 1949. The smartest investment you can make for the maintenance and protection of your new equipment is to begin with a sound lubrication program.

In setting up lubrication schedules for new equipment why not first investigate the advantages to be gained by using Cities Service fine quality petroleum products. Whatever the make and model of machine you'll find the right lubricant to meet your particular requirements. Moreover, an experienced Cities Service Lubrication Engineer will be on hand to provide sound recommendations on any kind of lubrication problem. You will find him especially well-informed on the lubrication requirements of the latest types of metal working machinery.

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Please send me without obligation your new booklet on "Metal Cutting Fluids."

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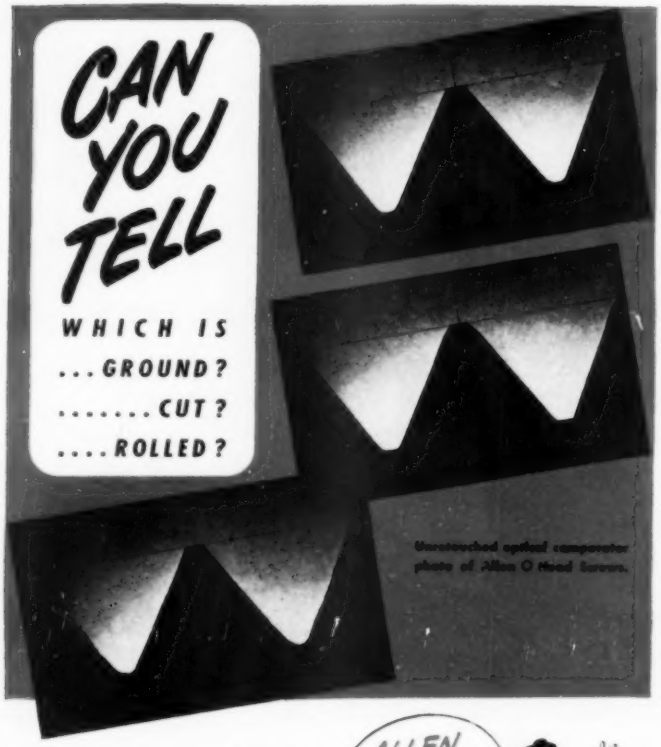

Find it hard to decide? Don't waste your time because threading method is purely our problem. Your interest is in *Uniform Class 3 fit*. You get it every time when you specify Allen O Heads instead of just Allen-type screws.

We use all the accepted threading methods depending on the metal, the size and, in some cases, the application. We investigate every new development and incorporate the best into our manufacturing methods. Because we do not commit ourselves to any *one* method, we can give you the *extra* precision and uniformity that makes Allen O Heads fit smoothly and stay tight under the most gruelling service.

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Write the factory direct for technical information and descriptive literature.

WARNING
Allen-Type screws aren't necessarily Allen-Made.
Get genuine "Pressur-formed" Allen O Head screws in this black and silver box.

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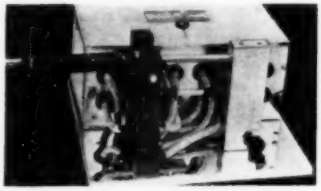
"baked on" finish and shows no tearing or tendency to pull off when placed on agitating conveyors after dipping. It is said to undergo temperature range from 70 below zero to 225 F above without cracking or peeling. The film is also resistant to dilute acids, alcohols and alkali, chemical fumes, grease, oil and water.

Black Ox Chemical Co., Newark, N. J.



Bench-Type Soldering Unit Generates Heat Within Work

Based on the principle of generating heat in the work instead of applying it externally, this bench-type fixture for soldering ferrules to flexible conduits can be operated either by non-locking foot switch or toggle switch. The mandrel supporting post and one of the electrode posts are hinged to permit fast loading and unloading. Electrodes are on a spring tension to provide proper contact pressure at all times. The equipment draws approximately 12 amps from 115-volt, 60-cycle source.

Durst Mfg. Co., 1110¾ Cumpston St., North Hollywood, Calif.

Reversible Screwdriver Is 9½-Oz. Pneumatic Unit

Built to drive No. 8 machine screws or equivalent, the Cleco A-1 reversible pneumatic screwdriver is 5 7/16 in. long and is said to be free from torque reaction. The throttle valve is open by pressure on the bit eliminating wasteful "free running."

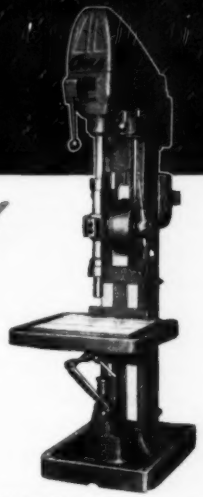
Cleco Div., Reed Roller Bit Co., P.O. Box 2119, Houston 1, Texas

Avey

The "One-machine" Production Line!

Standard Machines made *special* . . . yet still so versatile they can be converted into *other* cost-cutting production set-ups on future jobs. Avey's reliable BMA-6 is the most *versatile* machine in *any* shop.

Production of 300-400 parts per hour can be easily achieved on a set-up like the one shown above.



BMA-6 No. 3—a unique combination of sensitive and upright features. Standard frame motor for drilling and tapping . . . Hand or Automatic Feed . . . No. 3 or No. 4 Morse taper.

BMA-6 gives you: **3 Speed Ranges, up to 4800 RPM! . . . Double Row Ball Bearings at Spindle Drive! . . . Geared Meehanite Casting Transmission! . . . Unit Construction, for instant and easy part replacement! . . . Single-speed, Standard Frame Motor! . . . Multi-strand Vee Belt Drive! . . . Six Spline Spindle Drive! . . . Transmission gears shaved, hardened, and lapped! . . . Easy adaptability of spindles to multi-spindle drilling and tapping heads!**

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Avey DRILLING MACHINE CO., CINCINNATI 1, O.

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TECNI-TAPS

Ground-from-the-solid, Jarvis high-speed steel TECNI-TAPS save you 10%, and more, on procurement costs alone. Jarvis TECNI-TAPS have not gone up in price. Substantial savings are made when you work with Jarvis factory-trained representatives. Details, like number of flutes, lands, proper chamfer, are determined by these experts to create the TAP best suited to your tapping job. To get the most in profitable, trouble-free service from your TECNI-TAPS, investigate the Jarvis TORQOMATIC tapping attachment — there are savings for you with TORQOMATIC too! Address your requirements to The Charles L. Jarvis Co., Middletown, Conn.

Jarvis POWER TOOLS

TAPPING ATTACHMENTS
TECNI-TAPS and DIES
ROTARY FILES
FLEXIBLE SHAFTS and MACHINES
QUICK CHANGE CHUCKS and COLLETS

THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

Cleveland End-Mill Line Gets Face Lifting

Redesigned machine-polished flutes of this Cleveland end-mill line are said to give maximum cutting qualities at increased rates of speed. Other design innovations include elimination of sharp corners and points where localization of stresses might occur, new style clearance support for cutting edges, and elimination of pockets. Less breakage, more cuts per grind, and up to 50% increase in feed are reported.

The Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

Thin Graphite Film Applied to All Surfaces

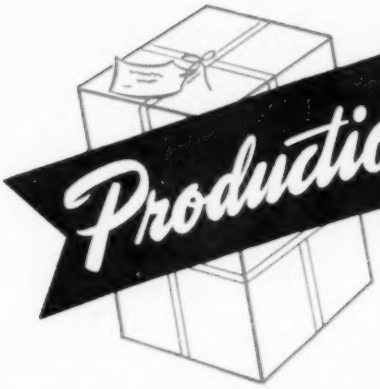
Stable graphite Electrofilm can be applied to metal, plastics, rubber, and ceramics by spray or dip, following normal surface preparation. Said to have excellent abrasion resistance and exceptional bearing strength, this lubricant is applied in films from 0.00015 to 0.0005 in. in thickness. Electrofilm provides the intended surface characteristics over temperatures ranging from 120 F up. Some variations have been tested satisfactorily to 2000 F. It is unaffected by exposure to solvents and weather.

Electrofilm Corp., 7116 Laurel Canyon Blvd., North Hollywood, Calif.

Solder, Brazing Rods Come in Plastic Packages

Designed for valuable alloys such as silver solder and phosphor-copper brazing rod, the "Siltube" No. 1 transparent semi-rigid shatterproof plastic tube contains 1 oz. of low melting-point silver brazing rod, and

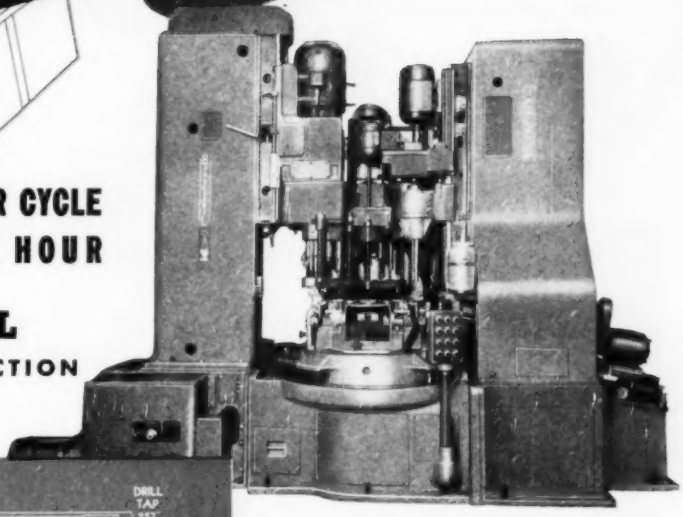
Production PACKAGE!

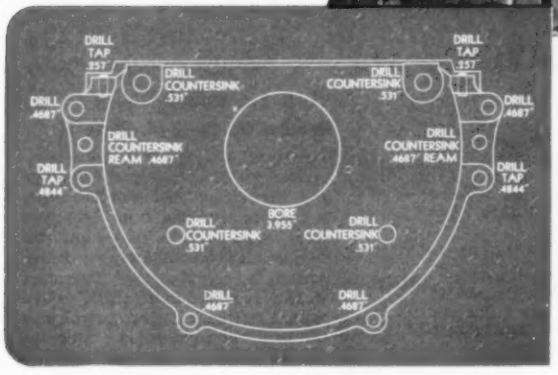


25 OPERATIONS PER CYCLE
80 PIECES PER HOUR

with

BARNESDRIL
UNIT-PRODUCTION MACHINING





Quick investment return — cutting production costs — reducing floor space and equipment — these ever-present production problems can be met in a single "package" with BARNESDRIL Unit-Production Machining.

On this job, drilling, boring, reaming, countersinking and tapping operations are combined into a single automatic cycle, with a net output of 2000 holes or 80 complete pieces per hour. Unit costs are greatly reduced. The operator is relieved of fixture changes and individual piece handling, and is required only to load and start the cycle.

"TAILORED-SKIL by BARNESDRIL"

BARNESDRIL Unit-Production Machining has wide application to many metal removal operations. A BARNESDRIL engineer will show you the potential increase in savings and efficiency which can be obtained on your work. Send blueprints for proposal, and ask for a copy of Bulletin B-1504.

BARNES DRILL CO.

830 CHESTNUT STREET ROCKFORD, ILLINOIS U.S.A.

REDUCE YOUR NUT-RUNNING TIME as much as 90% with Ingersoll-Rand

ROTARY ELECTRIC IMPACTOOLS

Size 4U—3/8" bolt dia.
Size 8U—5/8" bolt dia.

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AMAZING IMPACTOOL SAVINGS

Production Job . . . .

A fabrication process required removing rusted and cement coated nuts from 5/8" steel rods. With hand wrenches 60 units were turned out in a day. The Impactool jumped production to 150 units per day and the $197 tool paid for itself in less than 11 days.

Maintenance Job . . . .

Servicing transformers required the removing and replacing of transformer shields. Hand wrenches took 90 minutes; the Impactool did the job in only 9 minutes. The $110 Impactool paid for itself in less than 10 days.

Construction Job . . . .

A western building contractor used 2 Impactools to drive 1/2"x4" lag screws and run nuts on 3/4" bolts during house construction. The Impactools paid for themselves in the construction of 5 houses.

Versatile Impactool Saves 64 Man Hours on One Operation . . . .

Hand tools took 80 man hours to roll 300 3/4" boiler tubes. The Impactool, with a special tube rolling attachment, cut the time to 16 man hours. The tool costing $165 paid for itself in 13.8 hours' use.

Ask your distributor for a free demonstration.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

ORIGINATOR OF IMPACTOOLS—air and electric

445-18

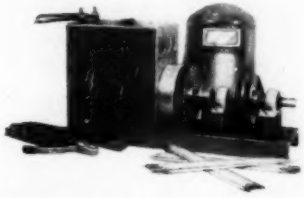
the "Phostube" No. 4 contains 4 oz. of Phosphor-Copper Brazing Rod. The former has a melting point of 1076 F and the latter 1300 F.

All-State Welding Alloys Co. Inc., 275 Ferris Ave., White Plains, N. Y.

Magnetic Plug Removes Ferrous Particles from Lubricants

U. S. Plug and Fitting Co. magnetic plugs are said to effectively remove ferrous metal particles from moving lubricants and hold them. A variable length non-ferrous supporting stem facilitates placing the magnets in the middle of the stream where it will do the most good. Cleaning is easily accomplished by a blast of air. Attractive force of the magnet is 11 ounces. Plugs in standard square head, countersunk, and special designs range in size from 1/4 to 1 1/2 in.

U. S. Plug and Fitting Co., Canton, Ohio.



95-Lb Arc Welder Handles Up to 1/4-In. Plate

The Model 202 Arc Welder has continuous welding rating of 200 amps and intermittent rating of 250 amps. It handles anything from light-gage sheet metal to 1/4-in. plates and can be mounted permanently or transported for portable use. Operating at 2500 rpm, the unit can be driven from a tractor, a 7 1/2-hp electric motor, or a 10-hp gas engine. Shipping weight is 90 lb and cost is $99.50 fob Chicago.

Manufacturing Div., Groban Supply Co., 1507 South Michigan Ave., Chicago 5, Ill.

Key Locking Device Has Self-Locking Nut

The "E-Z Off" key locking device is a coupling for attaching all kinds of connections to power shafts. Manufacturers' tests have shown this new coupling can be installed or removed in approximately 10% of the time required to take off conventional couplings. Self-locking nuts eliminate pinning the nut to a bolt shaft or axle.

Coffing Hoist Co., Danville, Ill.

*UNIFORMITY

Under all conditions, Tycol cutting oils more than meet the exacting requirements of the metal-working industry.

Rigidly controlled and tested during manufacture, Tycol cutting fluids retain their *UNIFORMITY — from the first drum to the last.

This unvarying high quality, plus the scope of the line, accounts for Tycol's wide acceptance among operators interested in finer finishes . . . freer, faster cutting . . . longer tool life.

Whatever your cutting need, let a Tide Water Associated engineer help you select the best fluid for your particular purpose. Call, write or wire your nearest Tide Water Associated office for full details.

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*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA" This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

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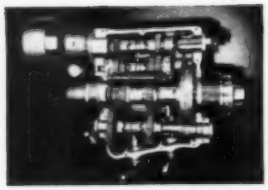

All gears are in constant mesh for smooth transmission of power with the back gear in front of the spindle gear. This arrangement of gearing counteracts the lifting action of the spindle due to the cutting force.

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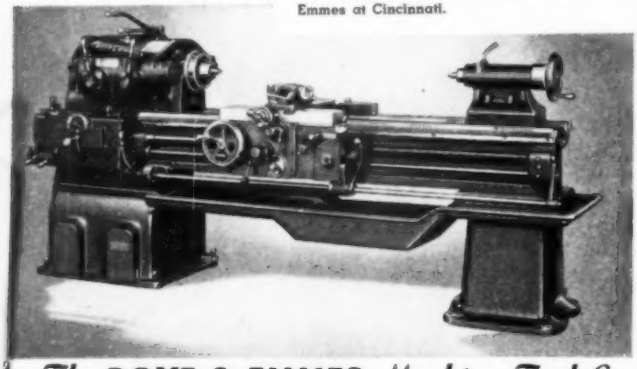
16 - INCH
HEAVY DUTY ENGINE LATHE

Boye & Emmes specialize in the exclusive manufacture of good, rugged, dependable lathes. These lathes you will find on precision operations throughout industry. Simplicity, ease of operation, power and rigidity, accuracy and long life are incorporated in all lathes designed and built by Boye & Emmes at Cincinnati.



The **BOYE & EMMES** *Machine Tool Co.*

125 CALDWELL DRIVE, HARTWELL • CINCINNATI 15, OHIO

TAPS LAST LONGER on this tapping head!

Taps do last longer on this Procunier High Speed Tapping Head. They stay sharper, longer, are held truer, do a more accurate tapping job for a greater length of time. Broken taps and "chewed" tap shanks are reduced to the barest minimum. *Here's why:* "Tru-Grip" tap holder keeps the tap rigid and in true alignment by the round of its shank, drives it by the square . . . tap shanks are never "chewed up"; the Procunier friction clutch helps operators avoid costly tap breakage at higher speeds. These and many other Procunier features *save you money* every single day they are in use! Get all the details on Procunier—the tapping heads that *make taps last longer. Write for full details and prices TODAY.*

PROCUNIER "TAP SAVER" The exclusive "Tru-Grip" tap holder is lighter, smaller in diameter. It affords easier tapping close to walls or shoulders, eliminates "chewed up" tap shanks.

Procunier
Safety Chuck Co.

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Gentlemen:

Please send your illustrated brochures which give complete prices and specifications on Procunier High Speed Tapping Heads and Machines.

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Cleaning Unit Removes Cutting Oils from Parts

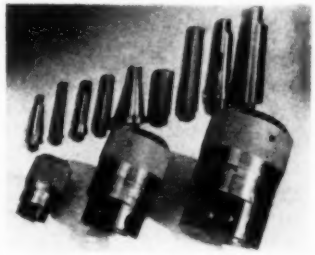
The Agitor Model H 81 "cold" parts cleaning unit, removes cutting oils from parts or from large castings and assemblies, and is said to be ideal for cleaning dies and machinery parts. It has a capacity of 100 gal. of solvent and is agitated by a high-volume centrifugal pump.

Graymills Corp., 2006 Ridge Ave., Evanston, Ill.

Rolled Gold Plates Eliminate Polishing, Finishing

The ASC Inter-Weld Process involves welding the gold layer to a barrier layer of pure nickel and then soldering this dual thickness to the base material in the conventional manner. Rolled gold layers are said to be far tougher and longer wearing than comparable thickness of gold electroplate. Ratios as low as 1/600 have been achieved with a karat gold thickness of 9/1,000,000 in. with no signs of bleeding. ASC interwelded gold filled and rolled gold plate can be supplied with a base of brass, nickel-silver, nickel-monel, cupronickel or berryllium-copper.

The American Silver Co. Inc., Flushing, N. Y.



Boring, Facing Tools Adapted for Quick Reversing

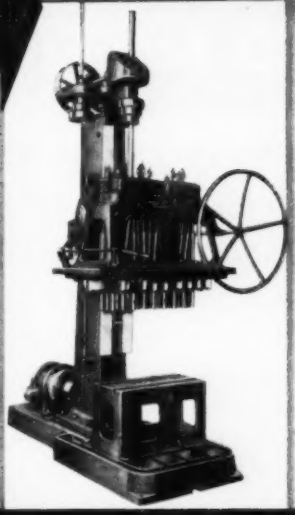
E-Z-Set, Model No. 41 (15-in. maximum capacity) and Model No. 42 (20-in. maximum capacity) tools

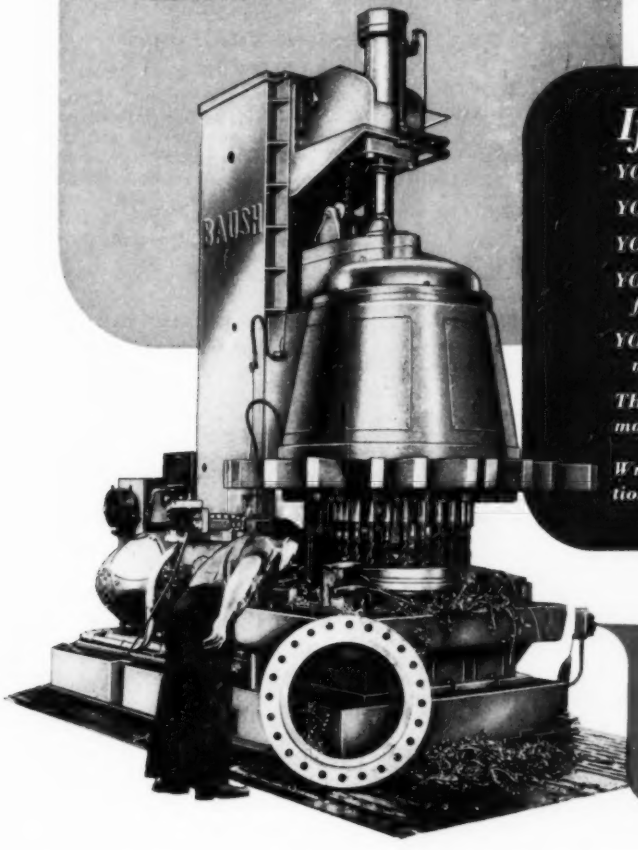
BORN 40 YEARS TOO SOON

. . . TO MEET TODAY'S COMPETITION

In 1910 Baush produced this drilling machine . . . the most modern of its era. It's still working and has paid for itself many times over . . . many such machines still in operation dramatically prove the lasting efficiency and dependability of Baush equipment.

However, *modern production methods require modern machines* such as THIS HEAVY DUTY DRILLING MACHINE designed by Baush to MEET TODAY'S DEMANDS . . .





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YOUR output reaching a New High

YOUR costs reaching a New Low

YOUR sales rising to a New Level

YOUR employees finding New Satisfaction in their work

YOUR finished product successfully meeting New Competition

THEN equip YOUR shop with modern machinery of BAUSH design

Write Attention Dept. HG for suggestions on shop modernization.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

In less than 5 months

PAID for ITSELF

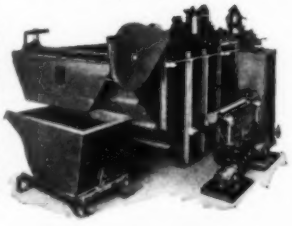
The Actual Savings Record of One Plant Using HOFFMAN Flotation Equipment

Based on One Year's Operation of 7 Centerless Grinders

	BEFORE	AFTER	SAVINGS
Total Shifts Operating	2860 hrs.	2860 hrs.	
Total Wheel Dressing	2860 hrs.	1450 hrs	
Labor for Dressing	$3,646.50	$1,823.25	$1,823.25
Time for Cleaning Coolant Tanks	954 hrs.	NONE	
Labor for Cleaning Coolant Tanks	$1,216.35	NONE	$1,216.35
Grinding Wheels (est.)	$1,556.00	$1,356.00 (est.)	$200.00
Diamonds (est.)	$1,100.00	$900.00 (est.)	$200.00
Soluble Oil	$915.00	$715.00 (est.)	$200.00
MAINTENANCE SAVINGS (Annual)			$3,639.60
PRODUCTION SAVINGS Based on 3,814 hours saved, evaluated at $5.00 per hr. per machine			$19,070.00
TOTAL SAVINGS			$22,709.60
INSTALLED COST of Hoffman Flotation Unit			$9,488.60

Get the Figures for *Your* Operations

Detailed cost records kept by one manufacturer revealed these phenomenal savings with a Hoffman central system for coolant clarification. Along with better quality and faster grinding, this plant saved production labor formerly wasted on cleaning individual sumps. A Hoffman flotation unit provided automatic clarification with the amazing economies shown above. These same cost-cutting economies can be obtained in your plant. Write *today* for literature and a FREE Hoffman filtration engineering survey.



Models from 20 to 1,000 g.p.m.
Larger capacities to your specifications

FILTRATION DIVISION

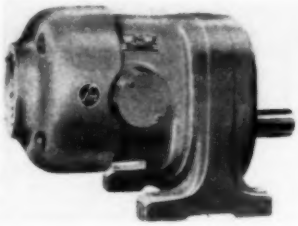
U.S. HOFFMAN MACHINERY CORPORATION

211 LAMSON STREET, SYRACUSE 6, N. Y.

CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

have been modified to include quick reversing. This feature permits quick reversing of tool block after it has been fed out to maximum facing diameter and stopped. Reversing is accomplished by (1) backing off socket setscrew which disengages facing mechanism from the driving scroll, (2) rotating the graduated dial manually to neutral, and (3) repositioning the setscrew. This new disengaging mechanism eliminates the necesisty of disengaging any of the prime precision fits.

The Maxwell Co., 300 Broadway, Bedford, Ohio



Slo-Speed Motor Equipped With External Fan

The Sterling "Slo-Speed," "Klosd-Tite" motor Type FWFB is totally inclosed, lubricated for life, and has labyrinth seals, liberal heavy-duty ball bearings, and sterling herringbone rotor. An external fan forces cooling blasts of air over the case.

Sterling Electric Motors, Inc., Los Angeles, Calif.

Free Machining Screw Stock Provides High Machinability

LA-LED is a lead-bearing cold-finished steel bar free-machining screw stock which is reported to provide from 44 to 106% better machinability than regular B-1113 stock. It is an open-hearth steel and is available on normal mill delivery in 5/16- through 3-in. rounds and in the popular hexagonal sizes.

LaSalle Steel Co., Chicago, Ill.

Chemical Cleaning Solvent Non-Inflammable, Non-Toxic

Aqua Turge is a formulation of strong emulsifiers that is said to penetrate, emulsify, and completely disburse any soil, grease, oil, or film. It is highly concentrated and water soluble. It is said to have a pleasant odor and will not evaporate.

The Brooks Boiler Treatment Co., 3304 E. 87th St., Cleveland 4, Ohio.

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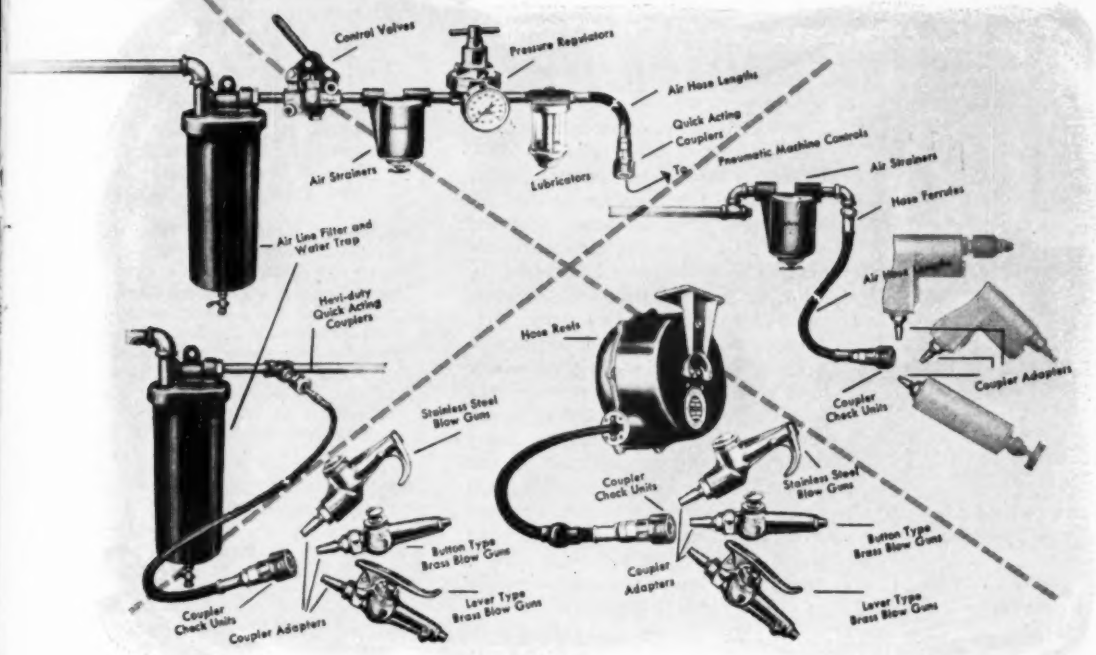
Regardless of the kind of air system you now have or whether you are planning to expand the use of compressed air in your operations . . . you owe it to yourself to see Schrader now! It's the most modern line—with many new types of controls, the complete line—with practically everything you can think of, every product planned to increase production, save air, reduce maintenance, and eliminate air losses. And it's backed by Schrader factory representatives and the nation's finest distributors—ready to help you. Send in the coupon . . . today!



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On hard-to-lubricate applications SPECIFY · · JOHNSON GRAPHITED BEARINGS

YOU can eliminate bearing troubles on applications where lubrication is difficult or liable to be neglected. Johnson Graphited Bearings are designed for 40 to 45% graphite contact with the shaft, thus supplying constant free-running without further lubrication. In addition, Johnson Graphited Bearings are highly desirable where ordinary lubricants may damage food, textiles and other goods in process. They are widely used on conveyor rolls, immersion rolls in textile and paper industries, pumps handling corrosive liquids, and many other heavy-duty applications. Johnson Graphited Bearings are manufactured in cast bronze and sheet bronze. They are available in serrated and in plug types as illustrated. If you have such a troublesome bearing problem, write, wire or call for further information.

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Graphite held permanently in place. Graphite area increases with wear. Not soluble in gasoline, oil or water.

SELF LUBRICATING LEDALOYL bearings, produced by powder metallurgy, are widely used for hard-to-lubricate applications where heavy-duty service is not an important factor. Johnson Bronze engineers will be glad to advise which type, Ledaloyl or Graphited, will best fit your requirements.

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NEW BOOKS

DIMENSIONAL CONTROL, THEORY AND INDUSTRIAL APPLICATION. *By the Sheffield Corporation, Springfield Street, Dayton 1, Ohio. 46 Charts, 28x32½ in., bound in rigid easel cover, with 24-page instructor's teaching booklet.*

A few of these sets, made up to aid in teaching wartime inspectors the importance of mechanical gaging equipment and how to use it, are still available. Until the supply runs out, Sheffield will send a set gratis to vocational teachers or schools who would like them. Originally the sets cost $15 each to produce; each weighs 16½ lb in its carton.

•

DELAVAL ENGINEERING HANDBOOK (SECOND EDITION). *Edited by Austin H. Church and Hans Gartmann. 6x9 in. Published by DeLaval Steam Turbine Company, Trenton 2, N. J. Price $2.*

Originally published in 1947, this handbook includes data on steam turbines, centrifugal and rotary pumps, helical and worm reduction gears, plus general mathematical, mechanical and fluid information. It provides a reservoir of information for power, industrial and design engineers. The new edition has been brought up to date and additional material included.

•

TOOL ENGINEERS HANDBOOK. *Compiled by the American Society of Tool Engineers. 2070 pages. Published by the McGraw-Hill Book Company, 330 W. 42nd St., New York 18, N.Y. Price $15.*

Tool engineering is reaching the status of a profession. This has come about for two reasons: First, by efforts of the American Society of Tool Engineers to broaden the effectiveness and voice of its membership. Second, the increasing complexity of mechanical industries, especially Metalworking, demands a professional, scientific approach, conditioned by practical experience, to the multitudinous problems connected with planning, control, design and tooling.

The crying need of tool engineers is for data to solve these problems as they arise. Even the many excellent papers presented at ASTE chapter meetings and national con-

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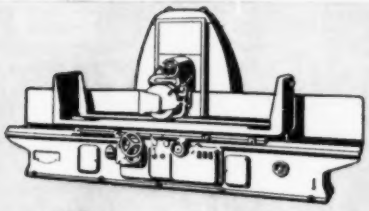
If its a Flat Surface to Grind
There's a Mattison to Grind it.

● With the addition of the production grinding machinery formerly made by the Hanchett Manufacturing Company, Mattison now is in a position to work with you on all your surface, face and disc grinding problems. These machines are made in various types to handle a wide range of work. Experienced fixture engineers are available to give you best production efficiency with Mattison Machines.

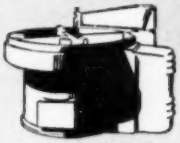
For any flat grinding, ask for our recommendations on the proper method and machine for your job. No obligation, of course.

For catalog on all machines, ask for free copy of general bulletin.

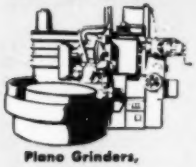


Precision Surface Grinders
Horizontal Spindle

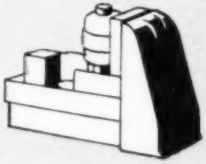
Disc Grinders,
Double Spindle Type



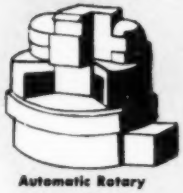
Vertical Spindle
Disc Grinders



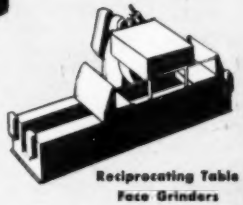
Plano Grinders,
Rotary Table Type



Rotary Table
Surface Grinders

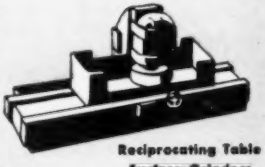


Automatic Rotary
Surface Grinders



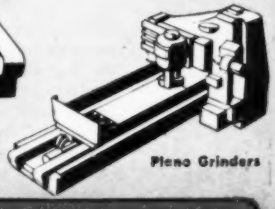
Reciprocating Table
Face Grinders

Disc Grinders,
Single Spindle Type

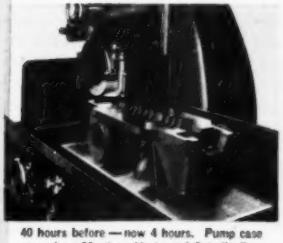


Reciprocating Table
Surface Grinders
Vertical Spindle

Face Grinders,
Traveling Wheel

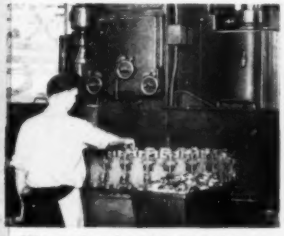


Plano Grinders

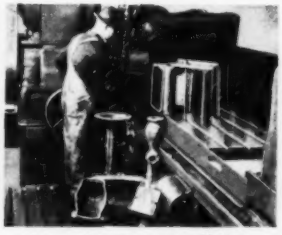


40 hours before — now 4 hours. Pump case ground on Mattison Horizontal Spindle Precision Surface Grinder

320 surfaces of cast iron compression heads per hour, removing 1.32" stock with Mattison No. 24 Rotary Surface Grinder



900 connecting rods per hour, using 40 station fixture to finish grind crank and wrist pin end of assembled rod with Mattison No. 72 Grinder



Shows variety of work run on Mattison Face Grinders

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

Do you recognize these HOLTITE fastenings? Guess what industry uses each of them. Check yourself by the list below.

CONTINENTAL makes them all and thousands more

Of all the 400,000 varieties of fastenings that literally hold our industries together, Continental makes a large proportion marketed under the famous HOLTITE trade name. Most of them are standard — screws, nuts, and bolts for every use in every industry. Others like the well-known HOLTITE-Sems and HOLTITE-Phillips screws are patented specialties and the famous HOLTITE-Thredlock, Locktite and Tap screws were first designed and produced by HOLTITE. Sometimes a fastening engineered by HOLTITE for one industry finds an unexpected use in another. Often a HOLTITE-*Engineered* fastening will replace several parts that a manufacturer is using. Why not discuss your fastening requirements with a Continental Sales-Engineer. He will focus on your requirements all the broad industrial-fastening experience and ingenuity of Continental. Remember Continental is constantly improving HOLTITE products, lowering their cost and broadening service.

ENGINEERED FASTENINGS FOR PRODUCT ENGINEERS

A. This chrome plated Phillips screw used on passenger guard rails in busses has a special shaped head to dress up appearance and provide additional shear resistance.

B. A special shoulder on this unusual HOLTITE Phillips motor bus seat adjusting screw assures snug, rattle-free fit between vehicle body and driver's seat.

C. The Phillips head on this special HOLTITE-Sems bolt speeds initial driving. The hex head allows use of a torsion wrench for final adjustments and repair in the field. This unique design cuts assembly time on truck chassis by several minutes.

D. An example of a HOLTITE "Lock-Tite" screw. The screw and lock washer come in one solid piece. With but one part to handle, assembly steps up and waste drops to a minimum.

This Trademark HOLTITE T. M. REG. U.S. PAT. OFF. *means made by—*

CONTINENTAL SCREW COMPANY

1904 NEW BEDFORD, MASS., U.S.A. 1949

ventions can only touch on a small portion of the subject matter of interest. Hence the Society decided to develop a Handbook that reflects the interests of its 18,000 members and will prove valuable to many others as well.

And so under the guidance of the A.S.T.E. Handbook Committee and Frank W. Wilson, editor-in-chief, 115 chapters were compiled. Each of these chapters, thoroughly planned in advance, was written by one or more authorities. Experts then reviewed and revised the contributions. The Society spent approximately $150,000 to be sure that it had a manuscript of exceptional quality.

There is much original material in the Handbook. Some data are derived from extensive tests, expressly undertaken to enhance the value of a particular chapter. Other data had been carried in the heads of experts but never published. Still other data are taken from standards, but of latest issue.

As one should expect of a broad-gage handbook, any one of many chapters is easily worth the price of the complete book. Tool engineering economics are discussed in detail. Production analysis and cost analysis are very capably handled. The principles of metal-cutting and machinability are presented in a basic manner and should enlighten many who have dealt with the subject for many years. And so it goes throughout the 115 chapters.

There is very little in the Handbook that a professional editor can criticize, either in respect to coverage or treatment of a subject. Instead, it is recommended that anyone, ASTE member or not, who has a responsible job connected with manufacturing, tool design or product design get a copy. Also, it is felt that the price is nominal, considering the scope of the Handbook, the quality and variety of the tables and diagrams, and the practical nature of the material.

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BIBLIOGRAPHY OF BOOKS AND PUBLISHED REPORTS ON GAS TURBINES, JET PROPULSION, AND ROCKET POWER PLANTS CIRCULAR 482—*By Ernest F. Fiock. Published by the U.S. Government Printing Office, Washington 25, D. C. 49 pages, 6 by 9 in. Price $0.20 per copy.*

Information on new power plants is covered by sections on turbo-jet, prop-jet, ram-jet, pulse- or intermittent-jet, gas-turbine, and rocket engines, and jet-propelled helicopter

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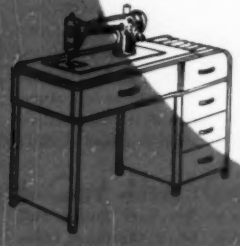
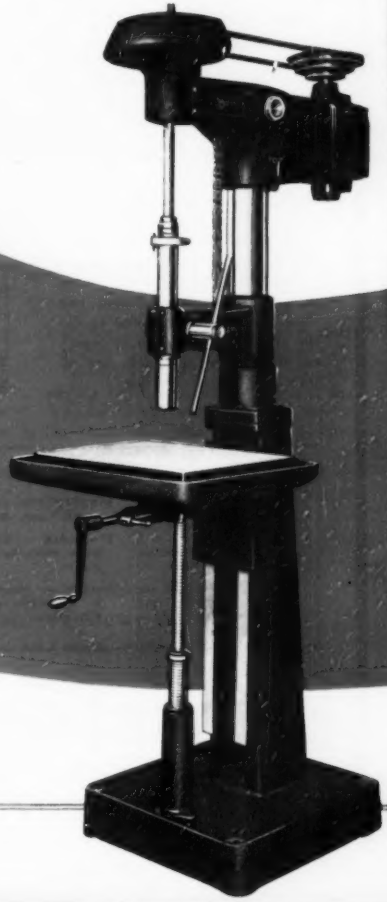
THAT BRINGS UNIT COSTS DOWN!

WHEN all is said and done, what the production manager needs in his drilling operations is the maximum number of holes per day. The greater the productivity, the lower are the unit costs in that department.

That's why, in plant after plant, the choice of drills has been "Buffalo". Ease of handling — simplicity of setup adjustments — rigid, rugged construction for lifetime accuracy — are the reasons.

If you want this profitable productivity, write us about your drilling operations, and we'll send you the "Buffalo" facts promptly.





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rotors and propellors, compressors, turbines, combustion and combustion chambers, aerodynamics, metallurgy, machining and welding, and ceramic materials in gas turbines.

Listings of material are by author for each year since 1939. Foreign remittances must be made at the rate of $0.27 per copy in U. S. exchange to cover mailing costs.

•

WELDING AND CUTTING MANUAL—*Published by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. 208 pages, size 6x9 in. Price $1.80.*

Intended for the practical welder, the maintenance man, and the up to date farmer, this book explains in simple terms the entire gas welding process. Copiously illustrated, it shows step-by-step photographs of actual repair jobs, explaining how and why each step is to be done.

Short cuts and simple methods of performing otherwise difficult jobs are given considerable space, and there are detailed plans for building all kinds of useful articles. Other chapters give instructions for bronze welding, soldering, hard facing, cutting, forming, and welding non-ferrous metals.

The appendix includes useful charts and tables, a glossary of welding terms, and a list of 100 repair jobs with recommended method.

•

HOT TINNING. *By W. E. Hoare. Published by Tin Research Institute. Fraser Road, Greenford, Middlesex, England. Available in U.S.A. from Tin Research Institute, Inc., 492 W. 6th Ave., Columbus 1, Ohio. 112 pp. 6 x 9¾. Free.*

A practical manual for working tinners, foremen and design engineers. Well illustrated and authoritative, this work keeps theoretical discussion to a minimum and reduces it to the simplest terms. Information is given on plant layout and on procedures for all the operations involved in hot tinning, including cleaning, fluxing and dipping. Composition and maintenance of the various baths are given, together with the method of preparation.

Techniques are given for tinning ferrous and non-ferrous metals, including new methods developed at the Tin Research laboratories. Methods of minimizing contamination, cleaning baths, and disposal of residues are dealt with. Booklet concludes with a chapter on examination and testing of hot-dipped coatings and appendix of useful data and conversion factors.

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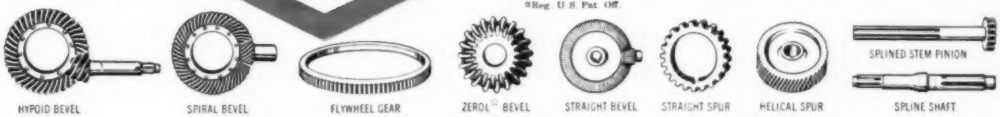

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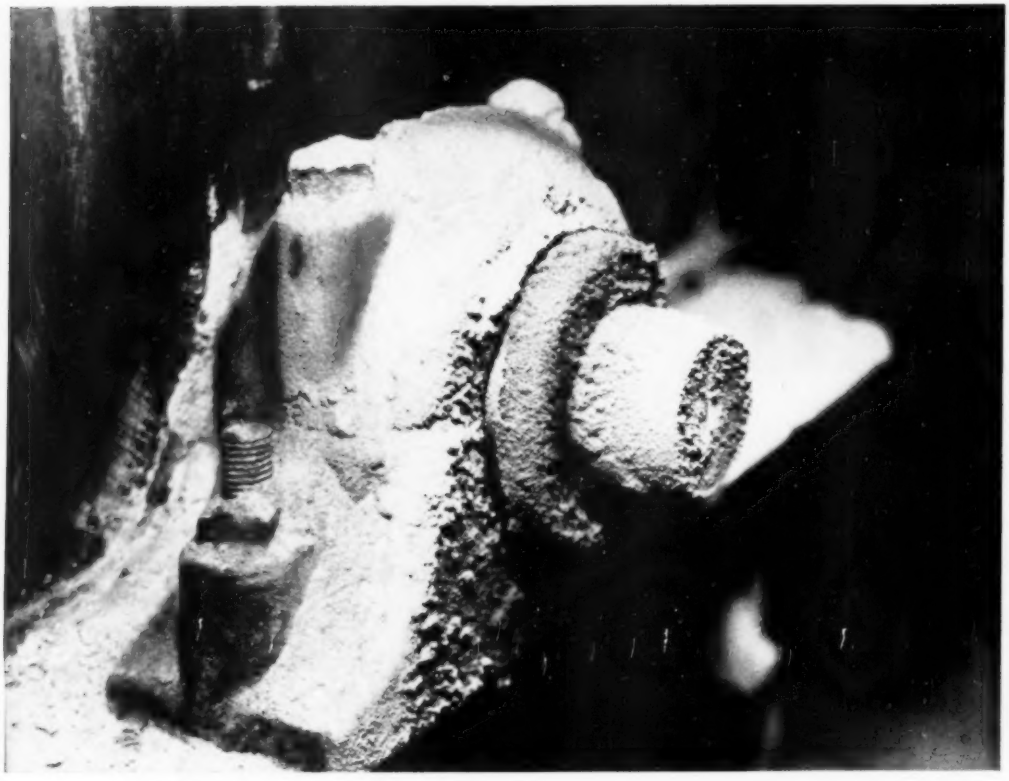

DEFIES ABRASIVE DUSTS!

The Famous Dodge-Timken Type C Bearings in Your Plant Assure Uninterrupted Production

POSITIVE TRIPLE SEAL —ANOTHER DODGE "FIRST"

WHEN you grind steel, cement, iron or rock you get dust — powdery, abrasive dust that seeps everywhere—except into Dodge-Timken Type C bearings like the one pictured above, which keeps the mill on which it is installed running smoothly at 3000 r.p.m.!

Wherever you have operating conditions of extreme dust and dirt, standardization on the Type C is your answer. Triple steel seals keep the lubricant in and the dirt out of this bearing, and in thousands of installations Dodge-Timken Type C pillow blocks are operating successfully under adverse conditions where other bearings failed. Rugged in construction, fully self-aligning, with both radial and thrust carrying capacity, Type C is suitable for heavy line shaft service as well as many machine applications.

For complete information concerning this bearing and other Dodge "Firsts" in power drive equipment call a Transmissioneer—your local Dodge Distributor. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

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The Transmissioneer is a graduate of an intensive training course at the Dodge factory. He can help you find the answer in applying power to the job.

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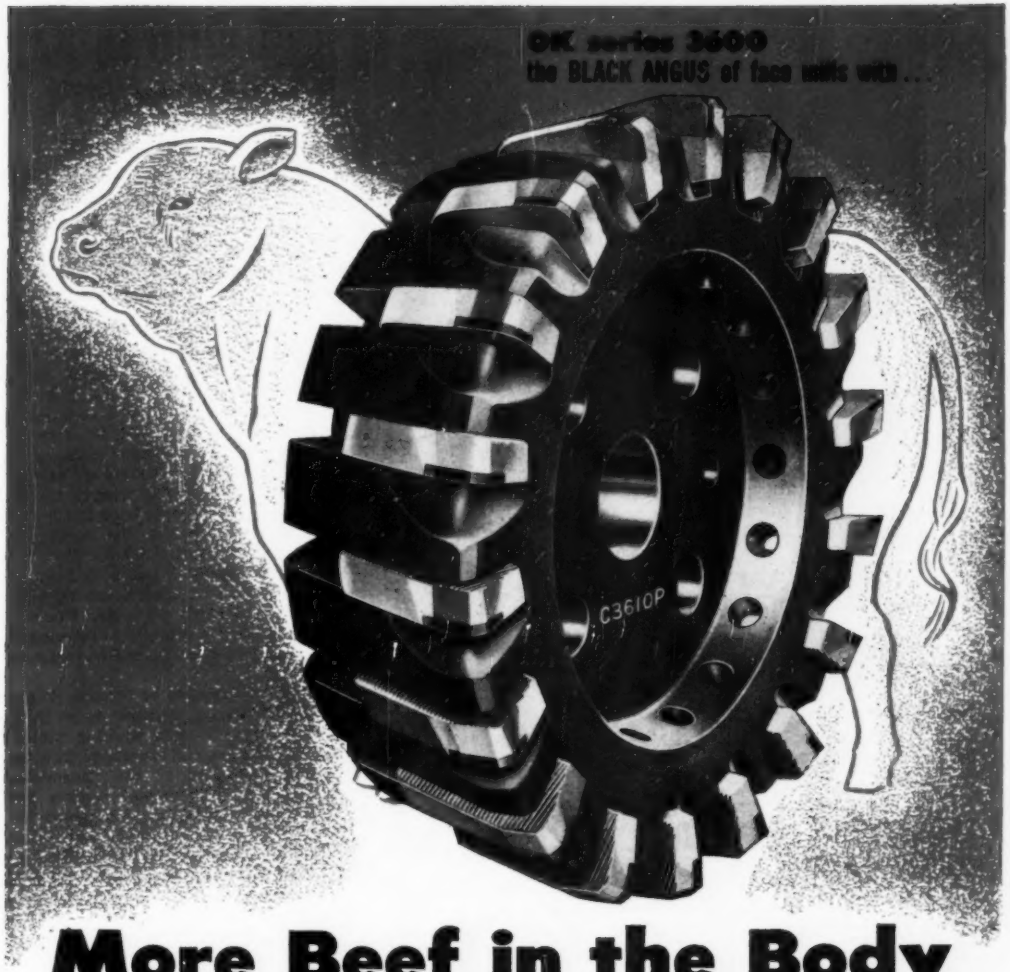


More Beef in the Body

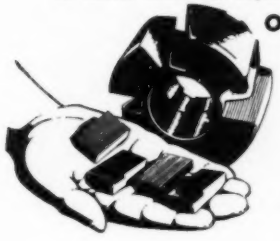
For the heaviest cuts that the biggest milling machines can pull.

OK Face Mills, size for size, have more weight, more substance, more beef in the body. And blades are huskier with a greater proportion of carbide available for cutting. It is a proven fact these cutters remove more metal in a given period than other cutters which are complicated and weakened by recesses for screws, pins, gibs or locking devices.

OK cutters consist of just two components — the body and the blades. Blades are simple wedge-shaped blocks, serrated on one face with matching serrations in the body. They are solidly seated by a driving fit, easily extracted with a drift, and stay put under the fastest speeds and heaviest feeds. The simple strength and ruggedness permit the placement of more blades in the fine pitch series and heavier blades in the coarse pitch series.*

You need the OK competitive advantages. Take your toughest job and let OK engineers have a go at it.

OK CUTTERS WILL OUTPULL ALL OTHERS



THE OK TOOL CO., Inc.
SHELTON, CONN.

***The wedge is the world's simplest and strongest basic mechanical device.**

TOWMOTOR Electric Pallet Truck

selected by WRIGLEY

for speed . . . maneuverability . . . ruggedness

Producing millions of sticks of chewing gum *every day*—billions every year—necessitates the unloading, storing and transporting of a staggering amount of materials. This is the problem at the Wm. Wrigley Jr. Company's giant Chicago plant—the world's largest chewing gum factory.

To help maintain top efficiency in a competitive industry, Wrigley must be constantly alert to new developments in the materials handling field. That's why Wrigley selected Towmotor Electric Pallet Trucks to augment its handling equipment.

One of the gruelling tasks is to transport and store 2400-lb. pallet loads on an inclined floor. The floor is rough board surface at an 8° angle. Towmotor is the only truck with enough power to handle full loads rapidly over this area!

In actual operation, Towmotor travels *faster* under *heavier* loads . . . weighs less, carries more . . . climbs grades more readily . . . stands up under constant daily use.

Check these outstanding Towmotor features:

- **Dual Finger-tip Control—either hand.**
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Write for the descriptive folder on Towmotor Electric Pallet Trucks. Learn how Towmotor **M**ass **H**andling methods can cut production costs and save money for you. Towmotor Corp., Division 56, 1226 East 152nd St., Cleveland 10, Ohio. Representatives in all Principal Cities in U. S. and Canada.

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FORK LIFT TRUCKS and TRACTORS

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ROUND TABLE *Discussion*

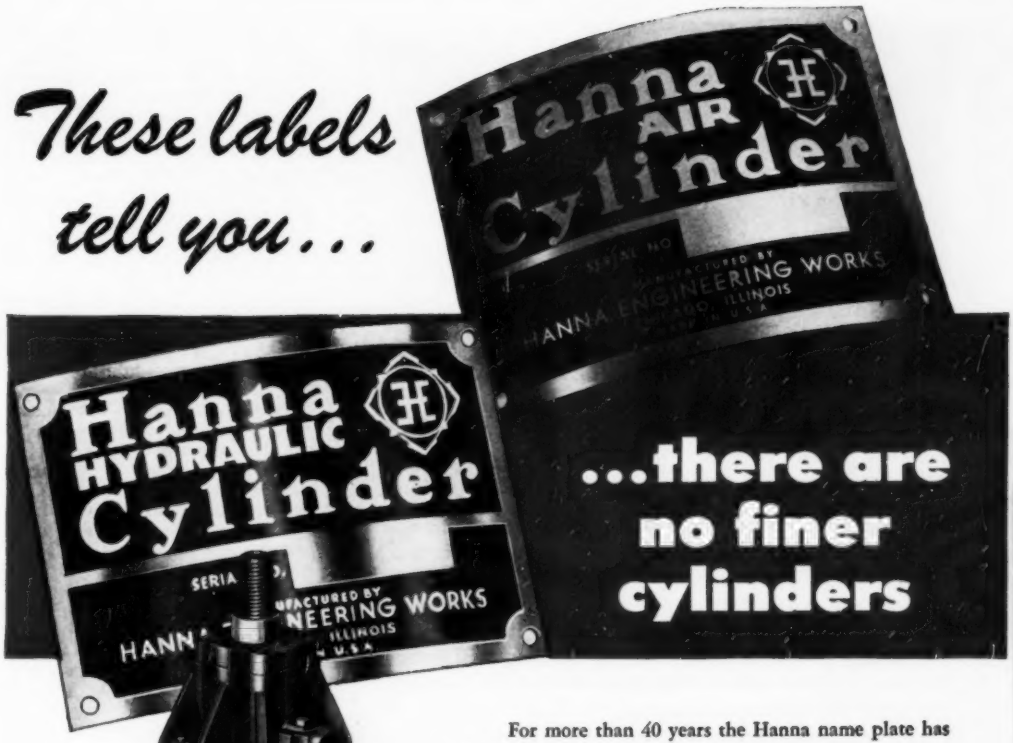
PASSING THE HAT

To pass the hat is one of the oldest forms of showing spontaneous sympathy with one's fellows, whether the reason be adversity, parting, or pleasure. The object and thought are so praiseworthy, that many people feel there are better methods of expression. To pass the hat calls for some person with time and sufficient interest to do it. It may be that the deacon of the local church and a too-frequent visitor to the local tavern may meet adversity at the same time and then could be seen the somewhat incongruous sight of hat being passed on behalf of, as some wag would say, the "church and the pub." Some people have felt hurt at the way in which the matter has been presented. Subscription lists have been used, but both have the objection that they waste time and may not reach all alike. One firm objected to the method and suggested a more effective and less wasteful method.

A fund was to be formed, its control and administration to be in the hands of the men working through a committee and secretary. This was to be known as the "benevolent fund." The proposed weekly contribution fixed at one penny per week, could be stopped from wages, if agreeable, and banked by the firm who offered to add a percentage to the total contributions. Rules were drawn up and membership cards issued. The entire scheme was volun-

"Hey, Mike, whatcha say you work out in the aisle for a while."

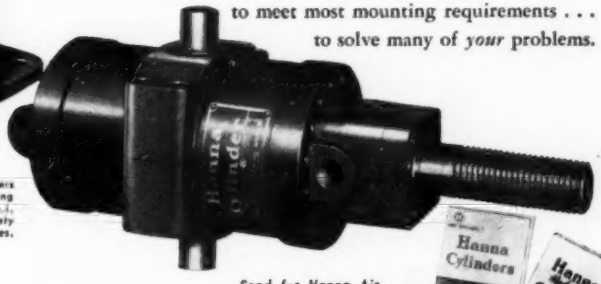
These labels tell you...



...there are no finer cylinders

Hanna Air Cylinders are designed for operation up to 110 p.s.i., and to 250 p.s.i. with minor modifications . . . in sizes from 1½" to 20" diameters.

For more than 40 years the Hanna name plate has been a familiar trademark-of-quality throughout industry. Those who demand the best in cylinder performance, reliability and long life specify Hanna Air and Hydraulic Cylinders for 1001 uses . . . to push, pull, lift, press, clamp or control . . . for the products they build for sale . . . to save manual labor and increase production in their own plants. There are standard Hanna Cylinders to meet most mounting requirements . . . to solve many of *your* problems.



Hanna Hydraulic Cylinders may be operated at working pressures up to 1500 p.s.i. . . . available in a variety of types and capacities.

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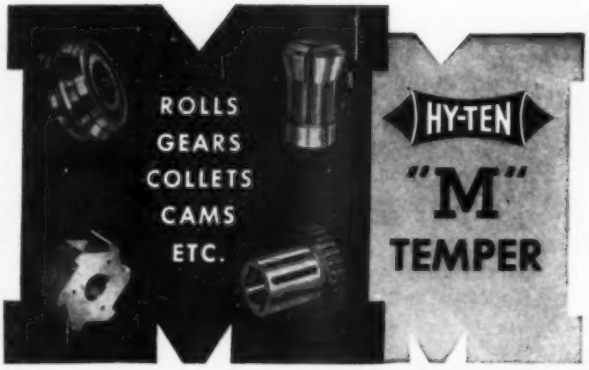
OVER ONE HUNDRED YEARS OF CONTINUOUS SERVICE. ROUNDS, SQUARES, FLATS, HEXAGONS, OCTAGONS



BILLETS AND FORGINGS FOR PRODUCTION, TOOL ROOM AND MAINTENANCE REQUIREMENTS.

THE ALLOY STEEL THAT'S *MEANT FOR PUNISHMENT*

"M" TEMPER oil hardening steel was developed specifically for such vital, punishment-taking parts as dies, cams, collets, forming rolls, clutches, gears, etc. "M" TEMPER effectively combines high hardness with maximum toughness, minimum distortion, extreme density and great strength – properties that ideally combine to resist wear and breakage. This grade develops the advantages of the powerful alloys – chromium, nickel and molybdenum. Moreover, "M" TEMPER has excellent forging properties and is readily machinable in the annealed condition. Although low in cost, "M" TEMPER has non-deforming properties comparable to, and in many cases superior to, much more expensive steels.

WL *steels are metallurgically constant. This guarantees uniformity of chemistry, grain size, hardenability—thus eliminating costly changes in heat treating specifications.*

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tary. Bases thought to be deserving could be reported by any member, all such to be brought before the committee. The funds were safe; the money could be obtained at will and it was not uncommon to hear the remark "tell the Benevolent." No hurt feelings; less likelihood of someone being overlooked and immediate and renewed relief always possible. Also no wasted time, or interference with production and the scheme worked.

P. E. James
Lincoln, England

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"IS IGNORANCE BLISS?"

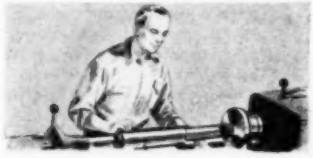
IGNORANCE may be bliss, but the shop man who is blissfully unaware of the details, assembly, and operation of the finished product he is working upon isn't in a position to help himself or the company put out a better product at less cost. There is no substitute for a shop man's knowledge and experience when applied to reducing production time and costs in manufacture of the product. When the worker is cognizant of the overall design of the product, and not just the one pertinent detail he is working upon, a fertile field for short-cuts is opened up. In today's specialized production arrangements, most workers are unfamiliar with the workings of their company's products. They fabricate parts for machines and equipment they never see or use when finished.

Foremen sometimes lose sight of the fact that it would be a boost to shop morale, as well as to company welfare, if the workers knew how the product which they produce works. A finished sample of the product on display in the shop as well as in the salesroom would be a good silent salesman for better worker interest and efficiency. A feeling of pride and satisfaction would be engendered in every man who had a hand in manufacturing the product. In addition, a thorough understanding of the assembled mechanism and how the details fit together would help the individual shop man better understand his part in the complete effort. Furthermore, the worker who is thoroughly familiar with the assembly of the product can be in a good position to discover improvements in its design and manufacture.

The development of the worker's creative spirit is one of the most successful means of raising plant morale. We all have the desire to make something, to see the results of our labor. If those who direct the worker's effort will take this into account, his

AXELSON FIRST CHOICE

MASTER MACHINISTS AGREE... there is no finer engine lathe than an AXELSON. Designed by men who are themselves master toolmakers, AXELSON lathes embody every feature that contributes to faster production, more accurate work, easier and safer operation, and maximum versatility.



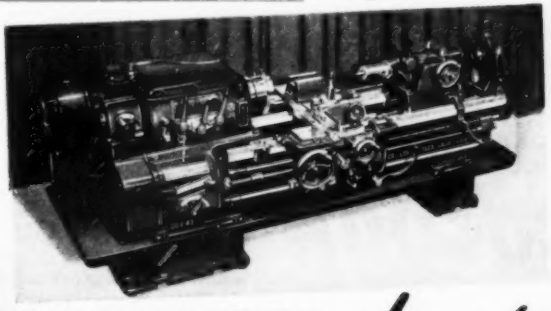
THE "FEEL" OF PERFECTION... is immediately apparent the first time a machinist puts the tool to the work in an AXELSON lathe. Velvet smooth control action... Continuous flow of power at the cutting tool without vibration or chatter.

THE TOOL CARRIES THROUGH... with precision accuracy from the beginning to the end of each cut. Massive construction throughout to maintain absolute alignment... Perfectly mated bearing surfaces on slides and ways... Heavy duty anti-friction bearings... Hardened and ground alloy steel gears... Rugged headstock, apron, tailstock, and gear cases.

HARDENED TOOL STEEL CARRIAGE WAYS—hardened tool steel carriage ways are supplied as standard equipment on all Axelson lathes. These precision ground ways are hardened and stabilized to insure perfect alignment and to prevent twisting or warping. All bearing surfaces are perfectly mated to assure maximum accuracy in all lathe operations.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

PRACTICAL VERSATILITY... permits a wide variety of operations with all types of tools, on any kind of stock... Two-speed tailstock... Wide range of feeds and speeds instantly available... Ram type turret, power rapid traverse, micrometer carriage stops, relieving and taper attachments, and many other accessories available for added versatility.



AXELSON *Lathes*

DEPENDABLE FOR A THIRD OF A CENTURY

AXELSON MANUFACTURING CO.

LOS ANGELES 11 • NEW YORK 7 • ST. LOUIS 16

Authorized Distributors in All Principal Industrial Centers

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TO PLANT EXECUTIVES

Complete illustrated descriptive literature tells the story of Axelson's Lathes. Write today on your company's stationery.

Protect your product with

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. . . PROTECTIVE PACKAGING For Your Machinery EXPORT as well as DOMESTIC!

Regardless of whether it is an Export or Domestic product . . . when you want to protect your equipment, ***COCOON*** is by far the most modern form of packaging for precision equipment!

Here you see an employee spraying the protective web-like ***COCOON*** on such a piece of equipment. This man could very well be your employee, for all the ease with which ***COCOON*** is applied.

Applied with a standard spray gun, ***COCOON*** provides a simple, extremely fast means of packaging parts, assemblies, or complete machines, regardless of size or complications in shape. Equipment packaged in this way can be stored in the open indefinitely, secure against snow, rain, wind, sun and humidity. How well this fits into your export and domestic shipping container program!

Whatever your protective packaging problem may be—whether it involves lathes, farm equipment, household appliances, metal surfaces or huge generators, ***COCOON*** meets your need. Protect your product with ***COCOON***. Write COCOON ENGINEERING SECTION today.

COCOON

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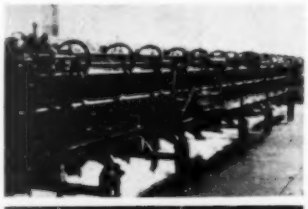
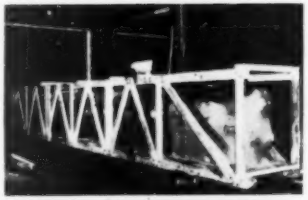
Here is how one company used *COCOON*





Whiz **Hollingshead** CORPORATION

Camden, N. J. Toronto, Ont., Canada

LEADER IN MAINTENANCE PRODUCTS

cooperation is likely to be assured.

It is a task of management to prove to the worker that he is not a cog in the machinery of production, but rather a vital section of the machine, regardless of how small his share in the production process may seem to be.

If workers are given expert leadership they will be loyal and conscientious employees and will increase their output and usefulness. Unit cost of making the product will drop where the foreman invites critical suggestions from the workers. Many potential labor-saving devices and improvements in mechanical processes for economical operation have been lost because the progenitors of such devices did not have the opportunity to present their ideas where good use could be made of them. The foreman should not lose track of the fact that the worker is capable of coming up with ideas for improving the product. There is no better way to learn things than to get the other man's point of view and ideas. Money-saving ideas and possible solutions to problems can only see the light if proper encouragement is given the suggestors.

The foreman who encourages suggestions on the work may see a lot of screwy ideas coming through, but the freedom of thought permitted amply repays for the idea. Improvement in methods, procedures and processes have devolved from ideas submitted directly by the men. It will be found that the men are full of ideas. There is a general "idea fertility" possessed by the workmen. A foreman should be proud of having men who are capable of working out new ideas. These are the men that he can look to when he needs leaders in his department.

The foreman who is opposed to the idea of allowing the workers to examine and study the finished product they are helping to manufacture is a fitting example of "the blind leading the blind."

Any means that will stimulate thinking along the line of product-betterment naturally deserves the active support of management. There should be no question that product engineering can be enhanced by permitting and fostering active participation by shop mechanic as well as designer in design improvement.

Harry Kaufman
Philadelphia, Pa.

•

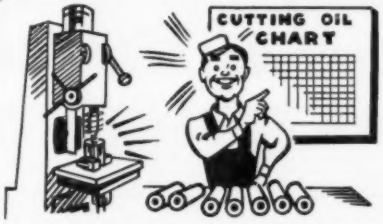
"WHAT they don't know won't hurt them!" may be literally true, but in most instances it's lousy psychology. As probably only 10% of our discoveries may be attributed to pure luck

Here's a tapping technique, you can see at a glance
Will show up the gambler who "takes a long chance".

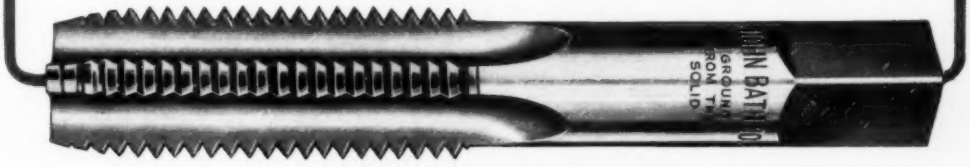
It leads to conviction, sentence and jail!
For it don't pay to have the wrong horse by the tail!

JOHN BATH CO. INC. · WORCESTER · MASS.

Some folks "take a chance" when tapping a hole
By running taps dry — with no friction control.



Just bathe your Bath taps with the right film of oil,
And your threads will be cut . . . according to Hoyle!



INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

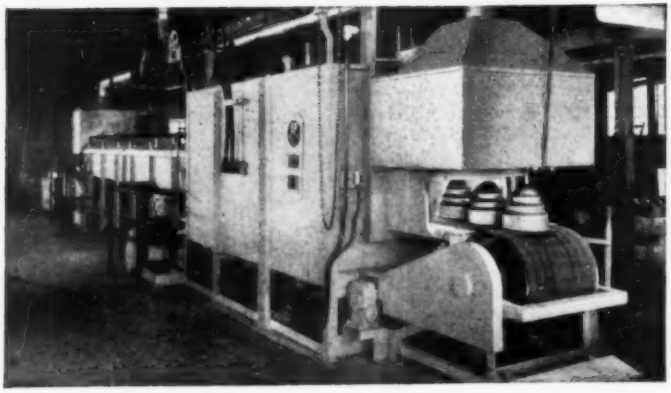
When running Bath ground thread taps, be sure to lubricate well and to select the RIGHT kind of lubricant for each type of material. Tapping fluid must be penetrating, must have satisfactory wetting or covering properties, ample film strength to prevent harmful metal contact and to provide decided cooling properties for minimum temperatures during constant operation.

Bath ground thread taps — whether stock or special custom built — are made to speed production and decrease threading costs. Write us about your tapping problems — we'll help you as we have many others.

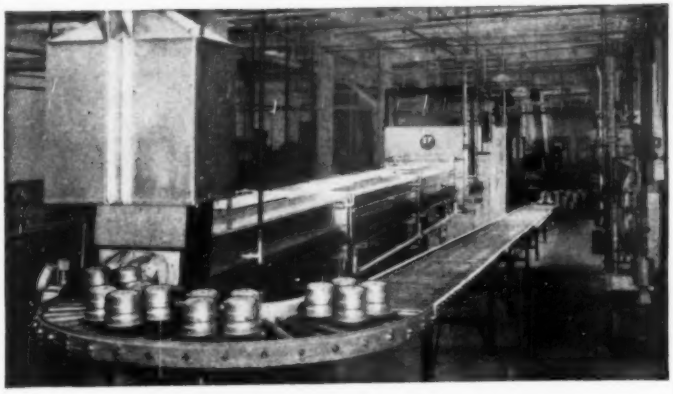
PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
22 Grafton St., Worcester, Mass.

EF FURNACE BRAZING



CUTS MATERIAL, TOOLING



AND FINISHING COSTS

● When it's costly to make a part in one piece—make it from several pieces, brazed together. Brazing can save from 50 to 80% in material. The brazed piece will probably weigh less—be stronger—withstand shock and vibration better, and wear longer. Brazing enables you to avoid costly die and tooling charges,—and since the finished pieces are discharged from the furnace uniformly bright, smooth and free from scale,—plating, lacquering, painting or other finishing costs are greatly reduced. Investigate the advantages of EF furnace brazing. Fully descriptive literature, complete with design suggestions, sent promptly. Write today.

EF **THE ELECTRIC FURNACE CO.**
GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION
Salem - Ohio

and the other 90% to the inherent curiosity of man, it is inconceivable that this seeking after knowledge is reserved for the few who make their living as recognized researchers. Leafing through any copy of the "Official Gazette" of the Patent Office indicates clearly that Joe Blow can hardly come in contact with anything without finding some means, manner or device for bettering its being, function or existence. The availability of educational material in the form of quiz programs, questionnaires, puzzles, question-and-answer games, through the media of press, radio or breakfast foods amounts to a constant barrage—but constant only because it supplies a need and is popular. In view of this, one is, when faced squarely with it, stunned at the prevalence of that recipe for happiness of the Dark Ages "Keep 'em barefoot and ignorant"—in modern industry. To admit surprise is to class oneself with those who can confess to ignorance of the presence and need for large numbers of missionaries, not in Darkest Africa but three blocks off Main Street, U.S.A.

People believe what they have before them, be it fact or the fruits of someone's imaginings. As not only does truth seem to be stranger than fiction but gossip has a keen sense of rumor—so good things involving company policy are not best left unsaid but should be given the widest factual publicity possible.

It is no good bleating about "our family," "our product," "our success," "our quality," if the worker is not allowed a feeling of sharing in interest as well as the money. Because of previous abuses fanciful or fact the employee is ever suspicious of propaganda.

How much easier it is and how

"You fellows look anxious about this job. Hell, I kin do it with my eyes shut—fact is, I usually do, ha!"

D.O.James

ESTABLISHED 1888

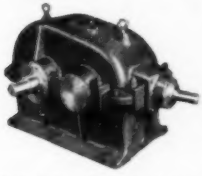
GEARED DRIVES MEET GROWING DEMANDS FOR POWER-SAVING EQUIPMENT IN INDUSTRY

Continuous-tooth Herringbone
Single, Double, Triple Reduction

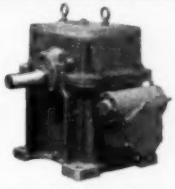
Type "H" Worm Gear

Straight Line Gear Reducer

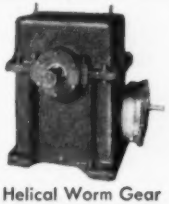
Motorized Reducers



Spiral Bevel Herringbone



Double Worm Gear



Helical Worm Gear

Motorized Worm Gear

Right Angle Gear Reducer

Spiral Bevel Gear

D.O.James Gear Manufacturing Co. is constantly developing and continuing to improve its variety of gear speed reducers — enabling engineers and designers of power-saving equipment to meet and cope with space limitations, horsepower requirements, ratios, location of driven or driving shafts and the type of drive that the many and varied installations require. Catalogs are available containing complete informative engineering data that will assist in the selection of the type of reducer for the specific job to be done.

D.O.JAMES GEAR MANUFACTURING CO.

Since 1888—Makers of Cut Gears, Gear Reducers and Flexible Couplings

1140 W. MONROE STREET • CHICAGO, U. S. A.

AVICO

FLEXIBLE PIPES WITH INTEGRAL ANGLE HOSE COUPLINGS

Send TODAY

For AVICO'S technical BULLETIN in color showing how AVICO hose assemblies with integral angle couplings:

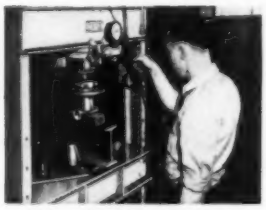
PATENTS PENDING

- SAVE SPACE
- ELIMINATE SHARP HOSE BENDS
- PREVENT TORSION OR TENSION ON HOSE
- REDUCE INSTALLATION AND MAINTENANCE TIME

AVICO Incorporated are specialists in the design and manufacture of flexible hose assemblies for conveying fluids and gases under all pressures and temperatures.
Send specifications of your hose installation requirements to AVICO and they will gladly design a hose assembly to fit your need.

AVICO, INCORPORATED
East Main Road Portsmouth, Rhode Island

FLARING AND FLATTENING TESTS
in Tube Mill Cut from 10 Minutes to 1 Minute by Using Dake 25PB Press



25PB applies 15-ton pressure on weld in tube flaring test.

Pressure from 25PB flattens tube between plates in welding test.

WORKER FATIGUE PROBLEM SOLVED

Exacting tests of tube welds performed every 15 minutes during a tube mill run are no longer man-killing jobs at Shenango Tube Co., Sharon, Pa.

Now, Dake 25PB performs both flaring and flattening tests, relieving workers of fatiguing hand testing, cutting testing time 88%.

When not in use on tube testing, press serves plant in general shop and maintenance work. Another example of the versatility of Dake Presses.

WRITE FOR BULLETIN ON THIS TIME-SAVING OPERATION

DAKE ENGINE COMPANY
636 Seventh St., Grand Haven, Mich.
Please mail latest literature to

Name.....
Company.....
Address.....
City.....

much more thorough the job to say when stressing the importance of doing one's work well—"as may be seen or understood by locating the parts you make in the model M718 now on display outside the Cafeteria". Or "Watch for our advertisements in your local magazine and on the plant bulletin boards—see how many parts you can pick out that you, your co-workers or your department have made or worked on—and by all means show them to your friends. They like all of us here appreciate quality workmanship."

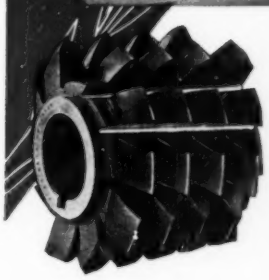
It matters not whether the article manufactured is one of daily use by everyone—or a fragment of a widgit that goes in the thingummy at Oak Ridge—nourish that pride in accomplishment!

We are certainly not very consistent in our views when we'll back up an all-out effort to educate the enemy during a war abroad and miss all kinds of opportunities at home—"to educate the masses!"

Thinking back, a perfect example of profit in correct thinking along these lines now comes to mind of visits to two plants of competing companies. Newcomers in a field starting about the same time there was already a startling difference in not only reputations but plant appearances. To shorten the story to our illustration, both plants had complete cutaway fully operating models of their principal product, beautifully executed and self-explanatory. Their major difference lay in the choice by the respective managements for their permanent location. In one, the model functioned all day long near the drinking fountain in the hall outside the main canteen, with occasional week-long trips to the different departments. The other rested resplendent on a special table within the works manager's private office from which it fared forth to the annual exhibition or the odd trade show. When one ties this in with over-all policy thinking, it certainly makes a strong indicator of the reasons for comparative success and failure of these two.

Admittedly there are and have been abuses enough to discourage the most ardent of "open-door policy" managements. Should the executives take time from a busy day now and then to conduct a group of workers on a tour of all plant operations and find one "tourist," the Union president, taking this opportunity to duck out from the group here and there to gab with workers at stations along the way, wasting not only his time for which he is being paid while on the tour but also all those workers with whom he talks, there would be

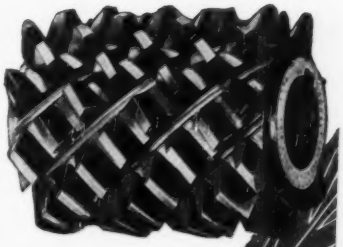
HOBS
of many
kinds
for many needs
where precision
and durability
are required

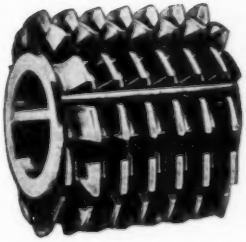


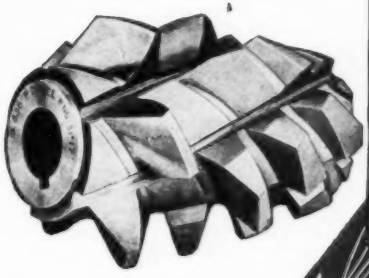
NATIONAL
CLEVELAND
TOOLS

NATIONAL Tools CLEVELAND

Cutting Tools for
All Purposes





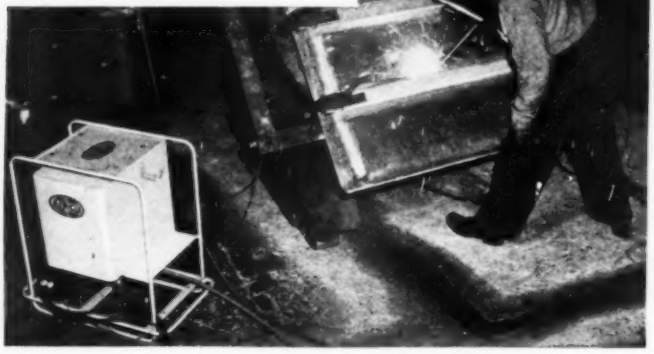


Herringbone Cutters,
Broaches, Gear Cutters,
Gear Shaper Cutters,
Circular and Flat
Form Tools,
Form Relieved Cutters,
ground and unground,
Hobs,
ground and unground,
Milling Cutters,
Special Tools

NATIONAL TOOL Co.
11200 MADISON AVE
NATIONAL Tools CLEVELAND
CLEVELAND, OHIO

new aircomatic process does three hours' work in fifteen minutes

MARTIN-QUAID COMPANY, a prominent metal fabricator of Philadelphia, Penna., received the job of constructing a number of special aluminum vessels from the IN-TAG Division of Interchemical Corporation. The established method of production seemed too costly of both time and money.



Dana V. Wilcox, Airco Technical Sales Representative, recommended the *new* Aircomatic Process with Airco Helium. Aluminum alloy ½" and ¾" thicknesses was used. The suggestion was adopted, and the process was applied to the job on a production basis.

Prior to the introduction of the new Aircomatic Process, Martin-Quaid used another arc welding method, but found welding time to be a disproportionate amount of its manufacturing costs. For example, the total welding time for a 4' x 5' x ½" side section of the vessel took three hours. With the Aircomatic Process, the three-hour period was reduced to fifteen minutes — a tremendous saving in time and consequently cost.

Due to the speed of the Aircomatic Process as a production tool, Martin-Quaid is planning to expand its aluminum fabrication facilities.

. . . .

TECHNICAL SALES SERVICE — ANOTHER AIRCO PLUS-VALUE FOR CUSTOMERS

To assure its customers of high efficiency in all applications of the oxy-acetylene flame or electric arc, Air Reduction has available the broad, practical experience of its nationwide Technical Sales Division personnel. The collective experience and knowledge of these specialists has helped thousands to a more effective use of Airco processes and products. Profit by this Airco "Plus-Value" service. Ask to have a Technical Sales Division man call today. Write: Your nearest Airco office. In Texas: Magnolia Airco Gas Products Company. On West Coast: Air Reduction Pacific Company.

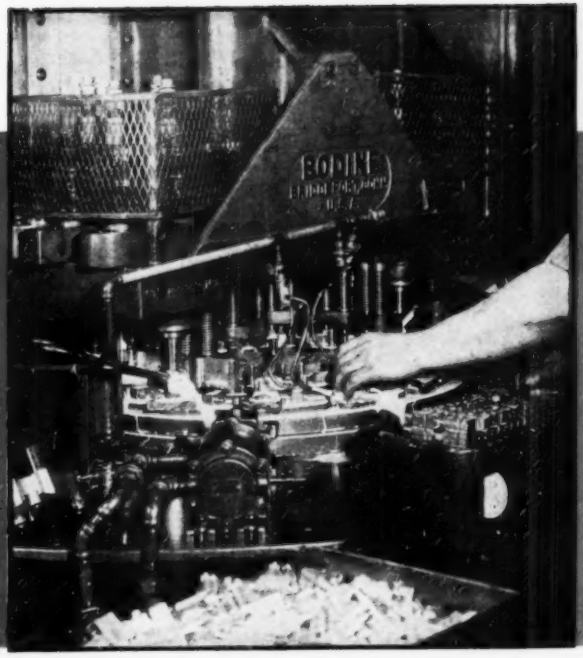
AIRCO **AIR REDUCTION**

Offices in Principal Cities

Headquarters for Oxygen, Acetylene and Other Gases... Calcium Carbide... Gas Cutting Machines... Gas Welding Apparatus and Supplies... Arc Welders, Electrodes and Accessories

small wonder in anyone's mind if on the next day a notice appeared to the effect that no further plant tours would be made. So often though, no such notice appears, but the tours do end. In this case there is nothing blissful about the ignorance of either party, particularly the workers, who, in the absence of knowledge of the real reason are either forced to make up their own or listen to the mutterings of those who take a particular delight in creating explanations, the more outlandish the better.

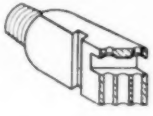
While this apparent sulking or negative viewpoint on the part of management does seem unbelievable, it must be remembered that they are individuals too and subject to the same mental ills at their level through ignorance as the workers are at theirs. It is this same attitude that stands amazed or disgruntled at the lack of enthusiasm to any management appeal that appears in the plant publication. Ignoring the fact that this same magazine or paper, which was brought out primarily to serve as a disseminator of company policy, while also serving as a means of "audience participation" and entertainment by and for the employees has too obviously become the former, insofar as the drive from the top has been missing and regularity of output geared only to those occasions when management had something special to "sell". All of which does seem a shame because, however misguided the approach, the messages of management are important, very important, to each and every member of the plant community and, to that extent the workers represent a percentage of their civil community. There are great reservoirs of good, sound information stored in top management which spread abroad opportunely among the members of their immediate community could allay a lot of fears and fumblings that unstabilize our state or national thinking in moments of plague, pestilence or flood, be they biological, political or financial. There can be little ignorant about men who have dug the foundations, built the physical and organizational structure, however small, beat the bushes and knocked on doors to establish markets, sweated out payrolls, fought competition, negotiated labor contracts, in addition to turning out a product at a profit. Had they or would they share this knowledge or that portion of it that contributed to their success on the levels that parallel a worker's domestic economy we should not be and ergo, they, and business generally, faced with the appalling shape of things to come. In this instance with particular ref-



Here's where
"DOUBLING
IN BRASS"
means

DOUBLING OUTPUT... or more

...and when we say "doubling" we are extremely conservative. In this case 8 different holes were drilled ... 2 also countersunk ... in a Brass Gauge Socket. Production 700 pieces per hour from the machine, 5600 operations per 50 minute hour.



Brass Gauge Socket

Bodine automatic Drilling, Milling, Tapping and Screw Inserting machines cut costs almost unbelievably. We have one report of up to $200.00 savings per day on each machine of a battery ... truly a worthwhile investment.

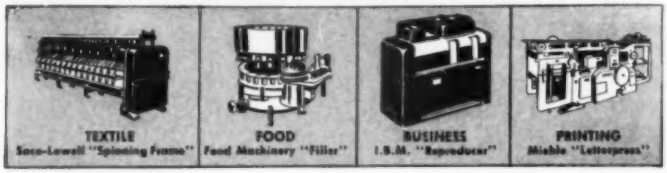
If you need repetitive production of small parts you need to know about Bodine multi-spindle automatics. Send for a Bodine Bulletin today ... it pictures modern production at its best.

"You can't meet
Tomorrow's Competition
with Yesterday's Machine Tools."

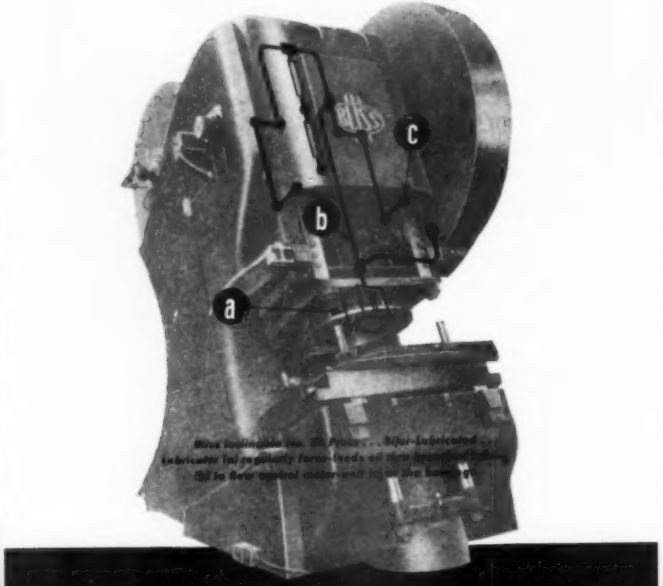
THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC RIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

2 BD 49

LEADING MANUFACTURERS STANDARDIZE ON THE BIJUR SYSTEM



reduce bearing wear



by controlling oil film at the bearings

Oil film at the bearings keeps the metallic surfaces apart, reducing wear to a minimum. This oil film must be maintained *constantly* to be effective.

Lubrication by hit and miss methods can't be depended upon to keep bearings running smoothly. Proper lubrication requires a system which force-feeds the correct amount of oil to all bearings and carefully controls the oil flow at each individual bearing *automatically*.

This is accomplished by Bijur, the system with positive Meter-Unit control of oil flow *at the bearings*. For further details write for "The A B C of Modern Lubrication."

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BIJUR
LUBRICATING CORPORATION
LONG ISLAND CITY 1, NEW YORK

erence to the individual, it may be readily said that since some one or some thing has led him into this predicament over which he individually now can have practically no control 'twere far better that he be left in that pink fog—where "Ignorance is Bliss."

A. M. Elliott
LeRoy, N.Y.

•

WHAT I think Al is driving at is that most men in his department are not acquainted with the product of the firm. He seems to sense the fact that in ignorance there is bliss—blissful torpidity. To bring that down to my level of understanding: doing the work for the mere satisfaction of getting it done.

It is very obvious that a workman must produce the work under direct instructions handed down to him by the foreman, but, even so,, one can do that as well as to feel alive inside —that feeling of being a part of the manufacturing world in which he spends so much of his time. In not being thoroughly acquainted with the intricacies of the complicated mechanisms, of the plant's various products, he is missing out—not only in that inner satisfaction that comes to one who feels that he is a part of things, but in being better able to work toward improvement. Even a dumb cluck can lay an egg—that's production of the highest order. Who is there to say that a double-yolker isn't the result of some mental activity. (I do know that some chickens think!).

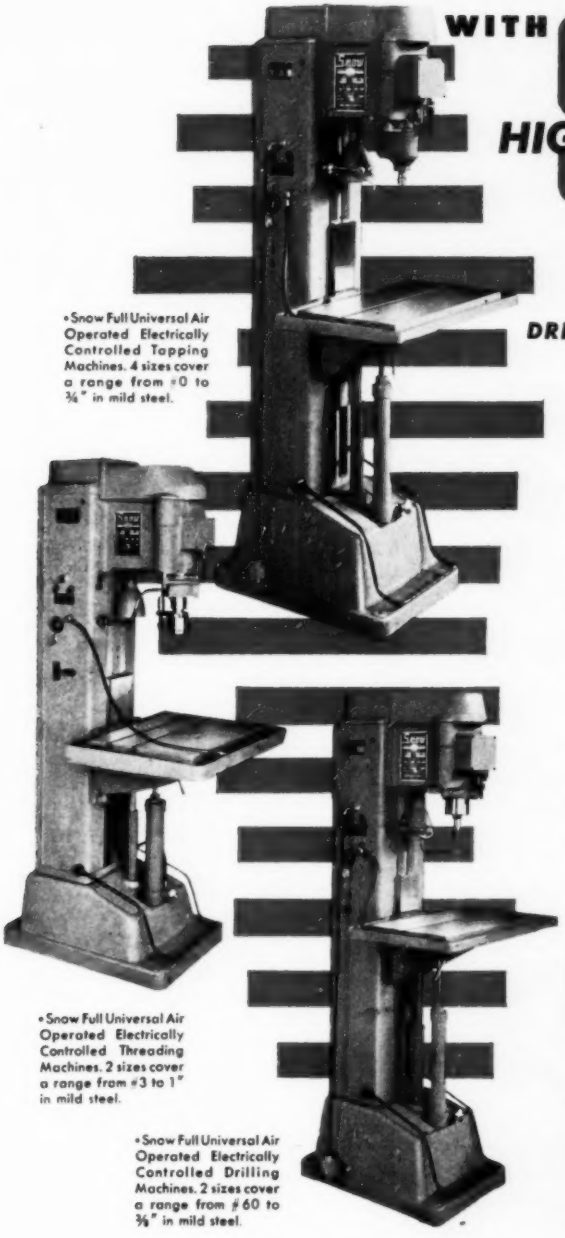
While the worker doesn't necessarily need a covering of feathers in order to make good, he can put his mind to work for the benefit of all concerned. If he is enlightened on things he is going to be better able to do this. What applies to machinery also applies to the human mind: constant use with care improves with age (until some scatterbrain gets to showing his stuff and wrecks it). The good-enough spirit is outmoded if one wishes to reach that pinnacle of industrial satisfaction. To be a satisfied worker, whether in terms of remuneration or the quality of the work he produces, is indicative of lethargy in some form or another. Comfortable ignorance is doldrum blissfulness but who in the heck wants to sail a boat without wind?

We have the two types of individuals who, when they see a ball rolling up hill will remark: "Gee! What d'you know!" and "There's something screwy about all this; I'll have to look into things and find out what's what."

Looking back on my own experi-

MEET SOARING PRODUCTION COSTS

WITH SNOW HIGH SPEED TOOLS



• Snow Full Universal Air Operated Electrically Controlled Tapping Machines. 4 sizes cover a range from #0 to ¾" in mild steel.

• Snow Full Universal Air Operated Electrically Controlled Threading Machines. 2 sizes cover a range from #3 to 1" in mild steel.

• Snow Full Universal Air Operated Electrically Controlled Drilling Machines. 2 sizes cover a range from #60 to ⅜" in mild steel.

AIR-OPERATED ELECTRICALLY CONTROLLED DRILLING, TAPPING AND THREADING MACHINES

•Today's severe competition will be worse tomorrow. It cannot be met with yesterday's machine tools. The new Snow Full Universal Air-operated, Electrically Controlled Drillers, Tappers and Threaders are the answer for maximum production of small parts. •Typical of advanced design and amazing performance is the Snow Full Universal Drilling Machine (bottom left). Drill sets its own rate of feed for increased output and greater tool economy. In thousands of installations it has demonstrated capacities of 6000 pieces per hour. Numerous types of Snow air-operated indexing and clamping fixtures and jigs are available for instant synchronizing to the machines. Our engineers will gladly study your parts and blue prints and submit highly profitable suggestions. Send for data on *all* these Snow machines.

SNOW MANUFACTURING COMPANY 439 EASTERN AVE., BELLWOOD, ILL. (SUBURB OF CHICAGO)

WENDT-SONIS

4 Point Plan

TO CUT REAMING COSTS!

1 LESS TOOL COST! W-S complete line of carbide reamers covers over 90% of reaming jobs. Reduced inventory!

2 GREATER ACCURACY! Precision tolerance as close as .0001. Lapped and protected grinding centers for more accurate resharpening.

3 BETTER FINISH! Grinding operations eliminated. All W-S reamers have diamond-lapped cutting edges and special hardened steel bodies stress-relieved before brazing.

4 IMPROVED DESIGN! New type of tool construction. Highly polished flutes with greater chip capacity.

Rely on the famous W-S complete line of carbide reamers — tried and proved for 15 years — to improve production at LOWER COST! Complete range of sizes . . . wide selection of styles . . . straight or taper shanks of hardened steel. Quick delivery on standard reamers with special diameters and tolerances. Make your next reamer order a W-S order . . . see your Wendt-Sonis distributor.

Free! NEW REAMING INSTRUCTION CHART

Determines speed and horsepower for cutting steel, ferrous, non-ferrous and non-metallic materials. Write today: WENDT-SONIS COMPANY, Hannibal, Missouri — 580 North Prairie Avenue, Hawthorne, Calif., 549 West Randolph, Chicago, Ill. Warehousing Facilities: Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.

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CARBIDE CUTTING TOOLS

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DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS
ROLLER TURNING TOOLS • SPECIAL BITS

ence, back in the production stone-age when belts squeaked "Gazinsky's Flowing Beard, in E Sharp" throughout the long ten hours, I recall the after hours we put in on our own time (two bits at time and a half would have shoved the boss to the wall) learning about the construction and whyfore of the Automatic Glynch. The Glynch had levers here and push knobs there and secreted on the interior were wheels, gears, arms and legs and sundry doodads sufficient to constitute a piece of complicated machinery worthy of its place in the annals of mechanical contrivances. While we were in the blissful state of ignorance it mattered none to us which buttons were pushed or which lever was pulled. All we gave a damn about was the fact that we got our two-bits per at the end of two weeks—with ten days of pay held back to protect the firm in the event that we should carry off one of the machines when the boss wasn't looking. To hell with the Glynch, we said as we multiplied four hours by two-bits day in and day out, but, after we became aware of the Glynch's potentialities, and were enlightened on its true functions, we all chipped in, mentally, and the result was the introduction of a Super-Glynch—entirely fool and competitor proof. All the salesmen needed to do was to push button #3764 and his prospect immediately signed on the dotted line. No, Eddy, my boy, I think Al's got you over a barrel in his reasoning—that knowledge is power and that being in the know will add a few pounds of steam to the old boiler.

J. Homewood
Ontario, Calif.

•

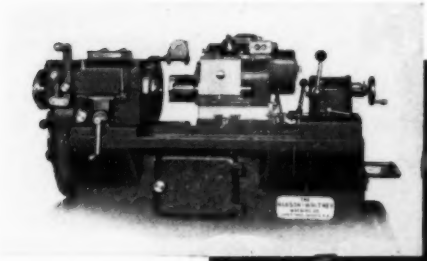
FOREMAN OR REFORMIN'?

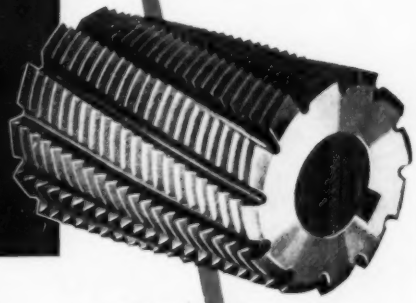
Company relations is not only the Personnel Department's headache but is also everyone else's from the president down to the assistant foreman. Management, as a team, has a lot of wishful thinking—thinking about how nice it would be if everything ran along like it did in the days before the war. Competition was tough, but not too bad in most fields. Unions were only just getting a foothold on labor, so we had labor conditions pretty much as we wanted them. There was not the vast amount of red tape from the government.

It is fine to dream back on the "old days," but it is action we need now and not just a dream of a better world. If management continues to sit back and just dream, they will find themselves just like the rest of labor . . . being controlled. Not by

STOP COSTLY SPOILAGE

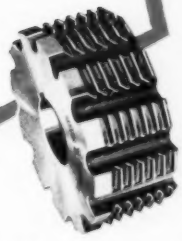
use Hanson-Whitney multiple thread Milling Cutters





Shell Type Cutter for external thread milling, Thread Rolling Dies, etc.

Taper Shank Cutter for internal thread milling.



Shell Type Cutter for short external threads.

H-W Ground Multiple Thread Milling Cutters are finished all over, AFTER hardening, to the closest of limits.

Angle of thread, relief and spacing of threads are very accurately controlled. Teeth can be spaced minus or plus to compensate for hardening variations in the product... a valuable feature on Cutters for Milling Thread Rolling Dies, as teeth can be spaced minus, to compensate for Helix Angle of thread.

Used in combination with H-W Thread Millers, H-W Cutters will give you 100% perfect threads on a production basis... without COSTLY SPOILAGE.

If you're having threading problems... here's the solution.

HANSON-WHITNEY MACHINE CO., HARTFORD 1, CONN.

Division of Whitney-Hanson Industries, Inc.

For practical recommendations submit your problems to Hanson-Whitney engineers.

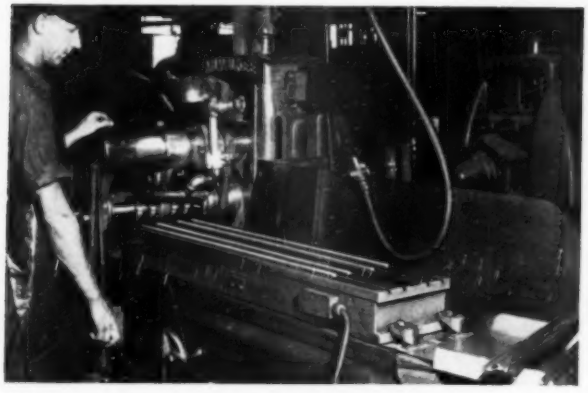
Hanson Whitney

PIONEERS OF FINISHED TAPS

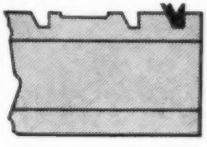
Tripled

PRODUCTION . . .

That's What Remington Rand Did with Magna-Lock Magnetic Chucks



JOB—mill clearance cut and 90° "V" cut on Carriage Rail Lower Race.



FORMER METHOD—climb milling (2 machines) two set-ups and two manually operated fixtures for each machine.

Production	—70 pieces per hour
Cost	—$0.0241 each
Rejects	—25%
Total Scrap	—6%

PRESENT METHOD—climb milling (2 machines) one set-up and one MAGNA-LOCK SUPREME 10"x48" Magnetic Chuck* for each machine.

Production	—200 pieces per hour
Cost	—$0.00812 each
Rejects	—none
Total Scrap	—0.2 of 1%

*PAID FOR BOTH CHUCKS IN 57 WORKING DAYS

C. J. Beard, Methods Engineer, Remington Rand, Elmira, N. Y., says:

"We are so well satisfied with the results of this set-up that we are in the process of tooling-up new parts, using MAGNA-LOCK Magnetic Chucks."

Write for complete details . . . Dept. AM-119

HANCHETT Magna-Lock **CORPORATION**

Magnetic Chucks and Devices

BIG RAPIDS, MICHIGAN, U.S.A.

unions but by a bigger and more powerful group . . . the government.

Foremen must do more than their given job if they want to hold foremanship in private indsutry. They must sell the free-enterprise system. Perhaps they don't know what it is. Sometimes I feel that our foremen today lack the educational requirements that should be given them by industry. How can a man taken from the rank and file of labor and given a management job because he is a "born leader" sell free enterprise to other workers? He is not told what a budget is, how it operates, how he and his department can make or break the company or other pertinent information. All he is told is that it is his job to get out production. He as an individual realizes that if you sell something you must make it—or is it that if you make it you must go out and sell it?

Some of the companies are training foremen to do a better job. Some industrial concerns are trying to sell the free-enterprise system, but not all of them. It is possible that some companies really look forward to being controlled by the government. Perhaps they want to be told that they may have profits of such and such amount and no more. Certainly by sitting back and saying we are headed for a socialistic government cannot stop it. Train your management team to sell the proper views on running a business. Tell them the truth and try to train your workers to understand what you mean. It isn't easy, but neither was the establishment of this United States.

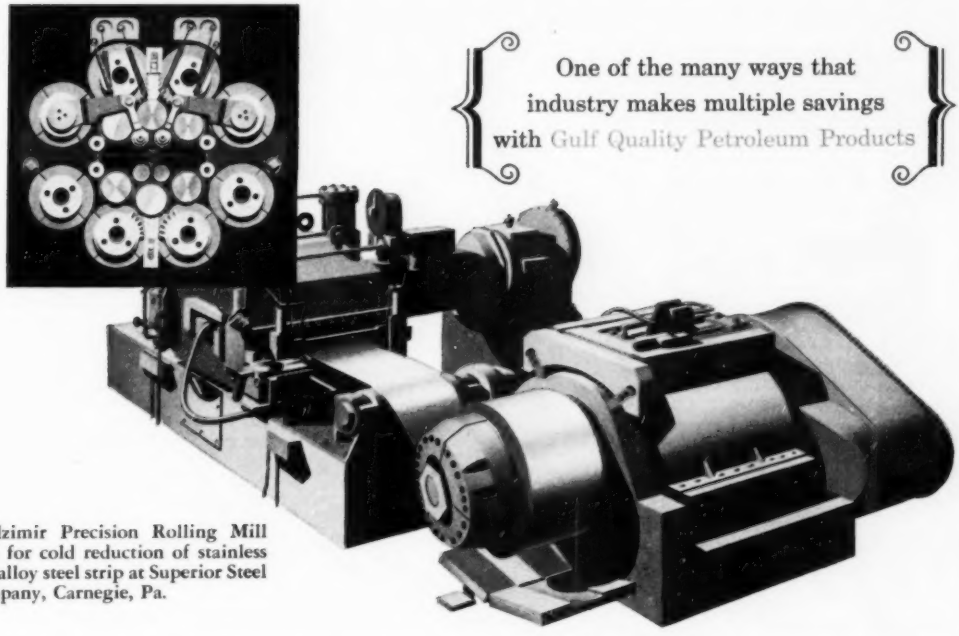
Foremen, your job is to educate as well as to lead. Take your company communique, digest it and then talk

"You loaned your side cutters to me, I loaned them to Joe, Joe gave them to Elmer, and Elmer loaned them to you, remember?"

GULF STAINLESS METAL OIL

extends roll and bearing life, improves strip finish in precision Cold Rolling Mill

One of the many ways that industry makes multiple savings with Gulf Quality Petroleum Products



Sendzimir Precision Rolling Mill used for cold reduction of stainless and alloy steel strip at Superior Steel Company, Carnegie, Pa.

Because the work rolls in this modern precision cold reduction mill are only ¾" in diameter, they attain reductions in strip thicknesses up to 50% in a single pass. Each work roll is rigidly supported by 9 backing elements instead of one back-up roll as in a conventional cold rolling mill. Extremely close tolerances are attained economically, even on medium gauges!

For this type of strip mill a quality oil with unusual properties is required. The oil must not only protect the bearings and rolls against wear, but must also help produce the desired strip finish. Then, too, it must leave no stain when the strip is annealed—must have good "burn off" characteristics, and it must be stable in order to resist all forms of oxidation.

Gulf Stainless Metal Oil is widely used in this precision equipment—for rolling both stainless and alloy steels, and is establishing outstanding performance records.

Another typical example of how Gulf Quality Petroleum Products are helping industry get greater production at lower cost. Make sure you are getting the advantages of recent developments in petroleum science. Call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
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GULF INDUSTRIAL LUBRICATION

Helps make machines produce more at lower cost

Amswiss
AMERICAN-PATTERN FILES
made to
AMERICAN
SWISS
Standards of
Perfection

For 50 years, Swiss-Pattern file users have been depending on "American-Swiss" for unvarying top quality in these precision tools.

Now, *American-Pattern* file users can have similar perfection by using "AMSWISS" Files. These American-Pattern files . . . made in a complete range of types, sizes and cuts . . . can be depended upon for uniform hardness and clean-cut, sharp, long-wearing teeth because of the high grade steel, closely controlled processes and rigid inspection standards in their manufacture.

When you need American-Pattern files for any filing job, assure fast work at low cost by specifying "AMSWISS." Write for catalog describing and listing the complete line.

Buy from our Authorized Distributor

AS-165

AMERICAN SWISS FILE & TOOL CO.
410 TRUMBULL STREET, ELIZABETH 1, N. J.
Also manufacturers of Swiss-Pattern files, milled curved-tooth files, rotary files and mechanics' hand tools

to your men. Maybe in a group, maybe individaully. You know your men better than anyone else.

Of course, just a piece of paper from the Big Boss isn't the true way your management team would operate. You should be called in to a metting to talk over the communique before it is even sent you. If this method is followed, foremen better understand the company policies and feel more on the "'in."

However, it is your job to train men to be better employees. Following through on all phases is part of that job.

Charles D. Townsend
Fort Wayne, Ind.

•

"TEN CENTS A CHANCE"

Raffles are gambles and gambling is an evil, to be discouraged in all of its many forms. One can imagine Al carrying the fight into church circles and waging war against bran tubs (grab-bag). Gambling must be put down at all costs whatever its form and wherever practiced. A man may be down on his luck; a Mahoney may be leaving the trade and desire to get rid of something—but no, he must not invoke the services of the elusive witch, chance. To do so would be to gamble, it matters not what the prize. And yet how narrow is the dividing line and how easy to transgress! It is that same elusive person who decides which team shall bat first and from which end a given team shall start play in a football match. The luck of the boss' possibility; possibility becomes hope, but who would say that hope should be discouraged?

The difference between a molehill and a mountain is, to some extent, one of degree. Each is an eminence, compared with the surrounding ground, but who would think of connecting the two? At the same time there is a principle involved but the definition of the dividing line, even if that be possible, would tax the wisdom of any Solomon who attempted it.

Without obstructing the needs of the potential Pattersons or Mahoneys would it not be discreet to evade the decision, emulate Nelson, blaming his blind eye, if necessary, and for firms to procure tools as required, supplying them at or near trade prices. This would circumvent Madam Chance without hurting any feelings and may save Al the unpleasant tasks of trying to convict his church of gambling. Industry could then adopt the attitude of the Pharisee and give thanks accordingly.

J. F. Powell
Lincoln, England

A quarter-of-a-million-dollar battery of duplicating machines represents only a small portion of the modern equipment in use in Allied's Richard Brothers Division plants. Here is *every* facility for the manufacture and try-out of sheet metal dies of practically every size and type. Here, too, are the men who know how to use this equipment—men with years of experience and proven ability in die-making. When Allied equipment and manpower go to work for you, you can be sure of maximum production and economy in your press operations.

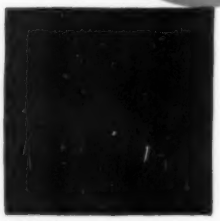
ALLIED PRODUCTS CORPORATION
Richard Brothers Division
DEPARTMENT 49
12605 BURT ROAD • DETROIT 23, MICHIGAN

HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS
SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC
MOLDS • SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES

Ellstrom

chromium plated gage blocks wear 5 to 20 times longer!

round



square

rectangular

How'd you like to make a big dent in your gage block costs? It's simple. Just specify "chromium" . . . Ellstrom chromium plated gage blocks. They're rated "tops" for all-around gage block quality . . . wear from 5 to 20 times longer than ordinary blocks, yet cost but very little more. Made of the finest materials . . . processed under precisely controlled conditions . . . and finally finished with their extra hard gaging surfaces through methods first developed and perfected by Ellstrom to give you longer wearing millionths.

Ellstrom chromium plated gage blocks are available in 12 standard sets . . . rectangular, square, or round . . . in working, inspection, or laboratory accuracies to meet every gage block requirement. Special sets, metric sets, or individual blocks are also available upon request. And every block in every Ellstrom set carries a positive guarantee of specified millionths to give you the accuracy and uniformity you need.

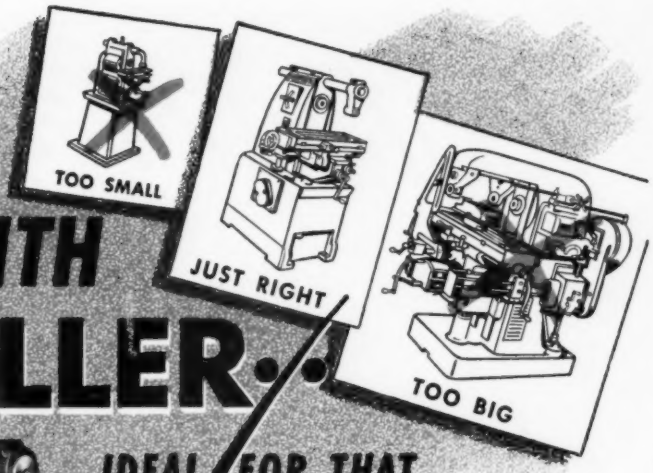
Ellstrom . . . *measuring in millionths for three generations.*

Do You Have the New Ellstrom Catalog? Contains complete specifications and prices on standard Ellstrom Sets . . . plus the new Ellstrom "Build-up" set, Internal Setting Gage, Inspection Service, and Trade-in Allowances. Send for your copy today!

For longer wearing millionths, specify **"Chromium"** . . . **Ellstrom** chromium plated gage blocks!

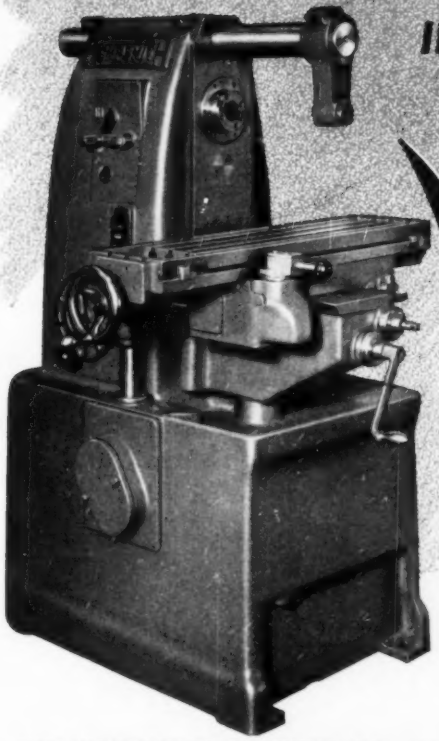
DEARBORN GAGE CO. 22035 Beech Street Dearborn, Michigan

Originators of Chromium Plated Gage Blocks



KEMPSMITH LH MILLER

IDEAL FOR THAT "IN BETWEEN" MILLING JOB



Yes — It's a light, horizontal milling machine — but RUGGED and DEPENDABLE like all Kempsmith Millers. Designed primarily to bridge the gap between low range hand millers and big, expensive machines, the LH MILLER combines simple, sound and rigid construction with flexibility and versatility — ideal for small end milling, high speed jig boring, keyWaying, oil grooving, light straddle milling, etc.

CUTS COSTS IN 3 WAYS — (1) Lowest initial investment and maintenance cost (2) Lowest possible setting up and tearing down time (3) Lowest power consumption. In addition, you are assured of the highest degree of accuracy and rigidity.

Write for Bulletin No. 127

THE KEMPSMITH MACHINE CO., 1823 SOUTH 71st STREET, MILWAUKEE 14, WIS., U. S. A.

KEMPSMITH

• Precision Built Milling Machines Since 1888 •

A 5508-1P-C

Tool up Faster!

with

CARMET CARBIDE METAL

STANDARD TOOLS AND BLANKS

Need cutting tools in a hurry? Just name the standard styles and carbide grades desired . . . get prompt shipment from a big stock *near* you.

Our line of carbide "standards" is complete. It covers 90% of all single-point operations. CARMET standard tools come ready to use . . . easy to modify for special purposes, by grinding. Style C, illustrated, is designed particularly for conversion into various shapes for numerous applications. Other standard CARMET styles also are immediately available from local stocks.

Order CARMET tools and blanks for better, faster, cheaper cutting. There is a grade to take care of every need.

WRITE FOR CATALOG C-2 . . . also for price list . . . great helps when you need tools fast.

Allegheny Ludlum Steel Corporation

CARBIDE ALLOYS DIVISION, Detroit 20, Michigan

Distributors: Write us about handling CARMET Standard Tools in your area.

your VICTOR distributor

a good man behind a good blade

Yes, Sir, when it comes to knowing what blade to use on metal or non-metal cutting problems . . . your VICTOR Distributor's long experience more than qualifies him to help you out. An expert on hack saw blades, he'll be glad to show you how to cut metals and non-metals easier and faster, and cut costs too, with VICTOR Blades.

VICTOR'S Steelrite Metal Marking Crayons

Ask your VICTOR distributor about these new and improved metal marking crayons. Available in a variety of sizes, these crayons, made of genuine soapstone by special extrusion process, are uniform in strength and composition. Markings can be made on hot, cold, damp or grimy metal and withstand pickling, yet do not affect enamel application.

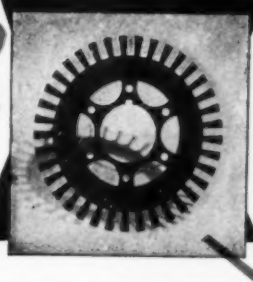
Don't forget to ask him for a free copy of the Victor Metal Cutting Book for your pocket or tool kit and the Victor Wall Chart for your shop . . . They'll help you get maximum efficiency from your metal cutting saw blades. Always keep your Victor line complete!

VICTOR

SAW WORKS, INC., Middletown, N.Y., U.S.A.

Makers of Hand and Power Hack Saw Blades, Frames and Band Saw Blades

DIE MAKER SAVED 40 HOURS on the die job for this part



CUSTOMER GAINED 375,000 ADDITIONAL PIECES

Armature lamination of silicon steel was punched out in a single crack in a hand fed press. Lempco equipped dies yielded 375,000 extra pieces over conventional die sets.

Die maker also saved forty hours in die assembly and tryout over previous record, due wholly to precision of preloaded ball bearing bushing of Lempco Die Sets.

LEMPCO DIE SETS

SAVE TIME IN DIE ASSEMBLY

GET MORE PIECES PER GRIND

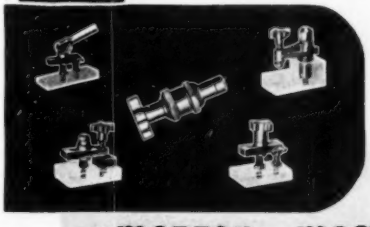
Dies open and close freely with perfect alignment that saves die wear, increases production per grind, cuts costly down time and yields pieces with cleaner cuts, minimum of burrs and rejects.

Write for catalog of STANDARD and SPECIAL DIE SETS with pre-loaded bearings between leader pins and bushings.

LEMPCO PRODUCTS, INC.

5490 Dunham Road, Bedford, Ohio

M-T FIXTURE CLAMPS AND COMPONENTS



BE DOUBLY SURE with M-T QUALITY

FIXTURE CLAMPS—wide range of sizes and types to fit every requirement. JACK LOCKS . . . Cam Locks . . . Hand Knobs . . . Hand Wheels . . . Steel Ball Handles . . . Soft Chuck Jaw Blanks . . . Fixture Cams . . . Alloy Set-up Studs . . . Rest Buttons and Rest Pads . . . Spherical and Plain Collar Nuts . . . Quarter Turn Screws . . . Fixture Keys . . . Spherical and Flat Washers . . . Shoulder Screws and many other items from stock.

Write for Complete Catalog.

MORTON MACHINE WORKS

2421 WOLCOTT ST. FERNDALE 20, MICH.

Because of its Knurled Head . .

. . SCREWS IN FASTER AND FURTHER BEFORE A WRENCH BECOMES NECESSARY . . . . .

UNBRAKO
KNURLED
SOCKET HEAD CAP SCREW

There is a definite saving of assembly time when you use "UNBRAKO" Socket Head Cap Screws with Knurled Heads. The exclusive Knurled Heads perform triple duty: (1) the *Knurling* provides a sure, slip-proof grip; (2) the *Knurling* speeds assembly, because it enables the "UNBRAKO" to be screwed in faster and further with the fingers—handiest of all wrenches—before a "key" becomes necessary; (3) the *Knurling* permits positive locking—a feature so often essential where there is excessive impact or vibration.

As always, the brand name "UNBRAKO" signifies *extra strength* and *precision manufacture to close tolerances*. "UNBRAKO" *Knurled* Socket Head Cap Screws are available in both National Coarse and National Fine Thread Series in a full range of standard sizes. Other sizes to special order. Write us for your free copy of the "UNBRAKO" Catalog and the name of your nearest "UNBRAKO" Distributor.

Knurling of Socket Screws originated with "Unbrako" in 1934.

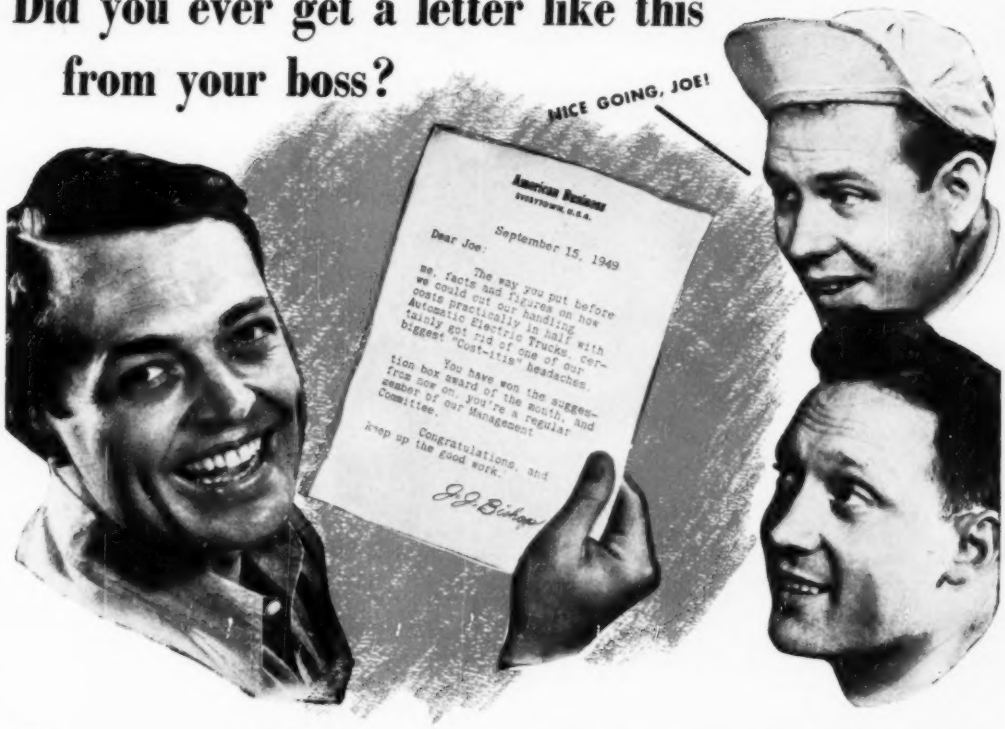
Other "UNBRAKO" Products include: Socket Set Screws with Knurled Cup Points, Socket Set Screws with Knurled Threads, Square Head Set Screws with Knurled Cup Points—all patented Self-Locking screws that *won't shake loose!* Knurled Socket Head Stripper Bolts. Precision-Ground Dowel Pins. Fully-Formed Pressure Plugs.

SPS STANDARD PRESSED STEEL CO.

BOX 4, JENKINTOWN, PENNSYLVANIA

"Serving Industry continuously since 1903 through Industrial Distributors"

Did you ever get a letter like this from your boss?


NICE GOING, JOE!
American Business
EVERYTOWN, U.S.A.
September 15, 1949
Dear Joe:
The way you put before me facts and figures on how we could cut our handling costs practically in half with Automatic Electric Trucks, certainly got rid of one of our biggest "Cost-itis" headaches.
You have won the suggestion box award of the month, and from now on, you're a regular member of our Management Committee.
Congratulations, and keep up the good work.
J. J. Bishop

The pay-off for Joe...he showed the Boss how to cut handling costs in half!

Sure, with prices under pressure, sales declining, profits being squeezed, the boss is apt to say: *"Lay low on capital expenditures."*

But if you take him at his word, especially when it comes to handling costs, you're not doing him, the business or yourself any good.

Whatever your manual handling costs are now, deduct 50%, and you'll have the cost of handling your products with Automatic Electric Trucks. Imagine what relief *that* would give your boss from his "Cost-itis" headaches.

So get yourself all the facts about these amazing electric trucks and lay them before him. With effortless, easy finger-tip control, they *lift, move* and *stack* hundreds of pounds, or tons and tons of your material so easily, a stenographer could operate them in a breeze.

Yes, these mighty giants of electric power do all the work. One man accomplishes as much as three men doing fatiguing *manual* handling. The other two can be moved to more productive, better paying jobs.

Send the coupon today . . . and when you get all the figures, you can show your boss the thousands and thousands of dollars these electric trucks are saving industry every day, and how *similar savings may be his!*

You'll be rewarded for your interest . . . and you'll be the man he will keep his eye on for the better jobs that are always coming up. Mail the coupon now, and see how fast things start looking up for you!

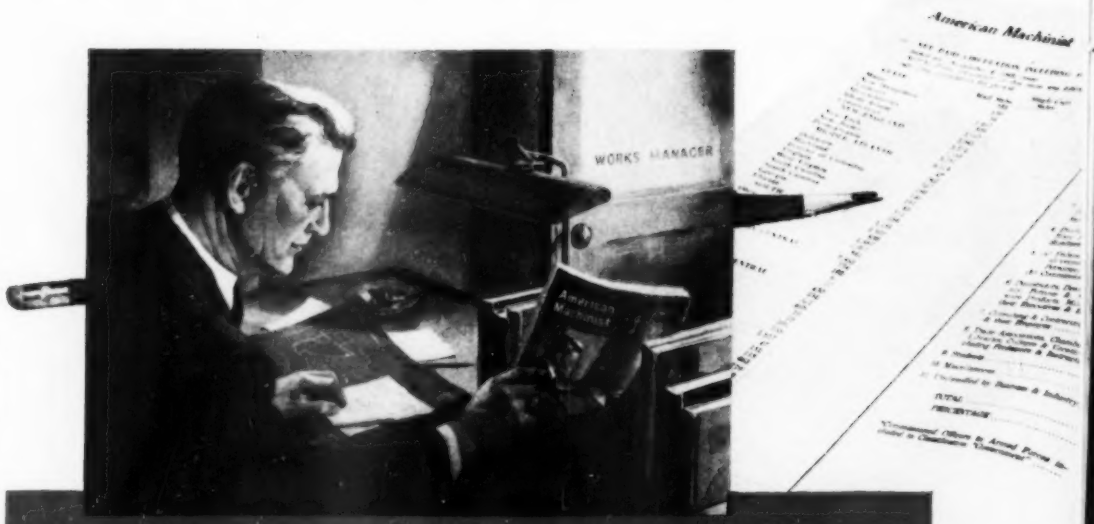
Trade **Automatic** Mark
ELECTRIC TRUCKS
Lifts Lifts Loads

TRADE **Automatic** MARK

59 W. 87th St., Dept. W-9, Chicago 20, Ill.

Please send me complete money-saving facts on amazing Automatic Electric Trucks, without obligation.

Company Name.....
By.....Position.....
Street Address.....
City.....Zone.....State.....



If metalworking production *uses* it . . . the production executive *buys* it

If your machinery, equipment, materials, parts, or services can help Metalworking manufacture better products, you need *American Machinist's* top coverage of Metalworking production executives.

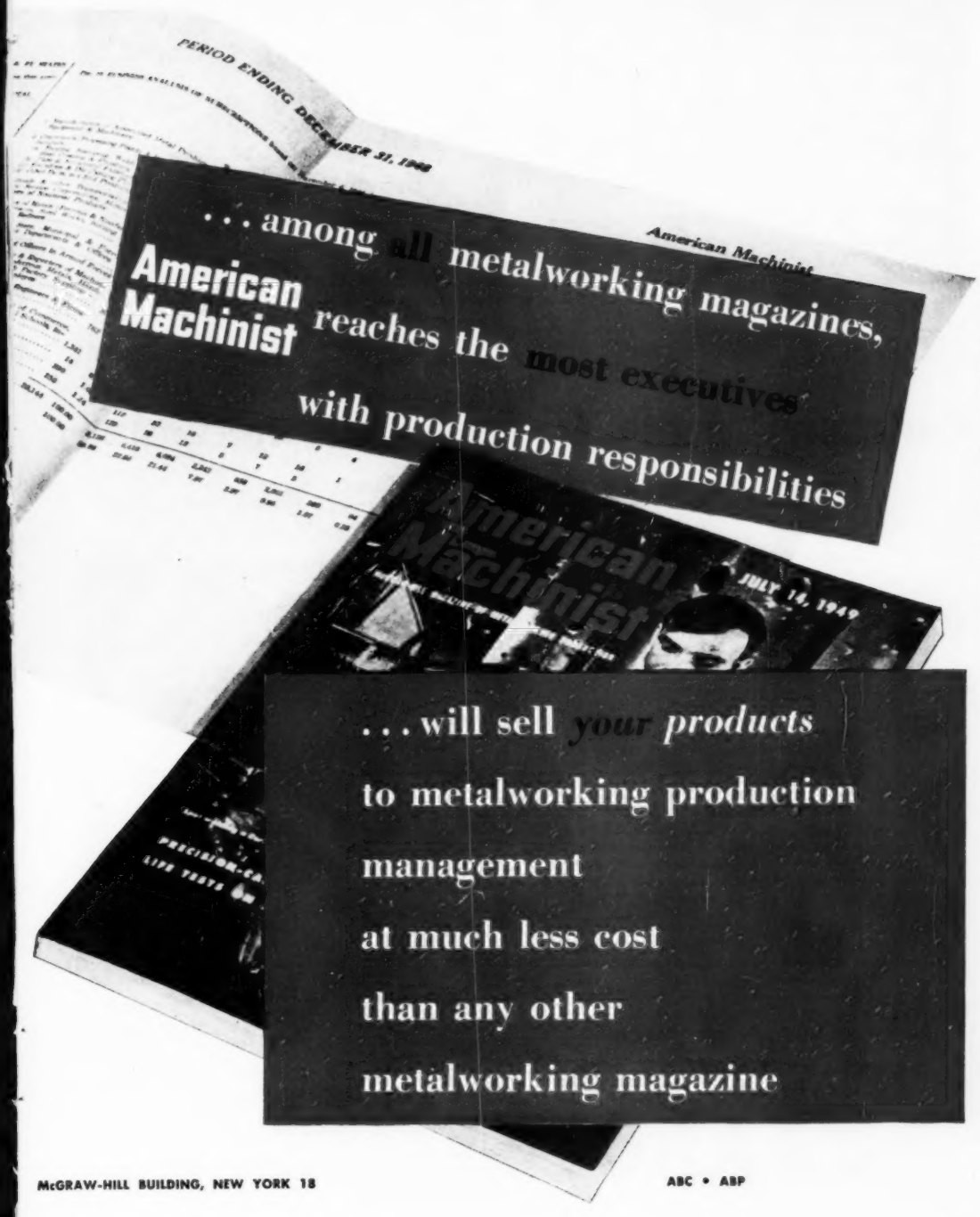
American Machinist subscriptions to companies; corporate officials and general managers; department managers, superintendents, and engineers outnumber *the total subscriptions* to any other metalworking magazine by over 5,000. And because these men *pay to read* this only magazine edited exclusively and specifically for metalworking production, *they identify themselves for you* as executives with major production interests.

Look at this magazine's powerful, constructive, editorial pages, and you'll see why over 500 advertisers invest more advertising dollars in *American Machinist* than are invested in any other metalworking publication.

Study *American Machinist's* latest ABC statement, and you will know why this magazine is *your* most important metalworking buy.

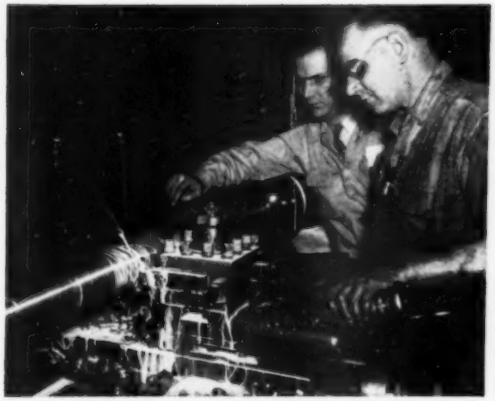
Compare *American Machinist's* ability to sell your products to metalworking management at the *lowest* cost-per-contact . . . and you will want to *concentrate your advertising* in the *one* magazine which *concentrates its pages* on serving Metalworking's production management.

THE McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

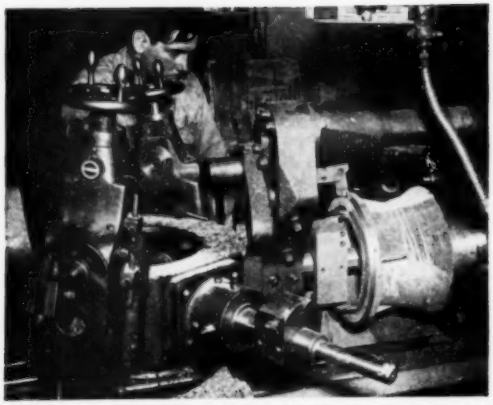


McGRAW-HILL BUILDING, NEW YORK 18

ABC • ABP



Time reduction of 52 minutes! On this multi-diameter shaft-machining operation, carbide tools did the job in 116 minutes as against 168 for high-speed steel. "Triple C" assured correct design and application of carbide tools, with maximum production efficiency.



30% to 50% saving in machining time! This amazing saving was achieved when Carboloy-tipped multiple bar tools, designed and fabricated in the company's plant under "Triple C," were used in machining this cast-iron suction head. Here is just another example of "Triple C" results.

Carboloy "Triple C" Plan cuts machining time 40% at large pump works

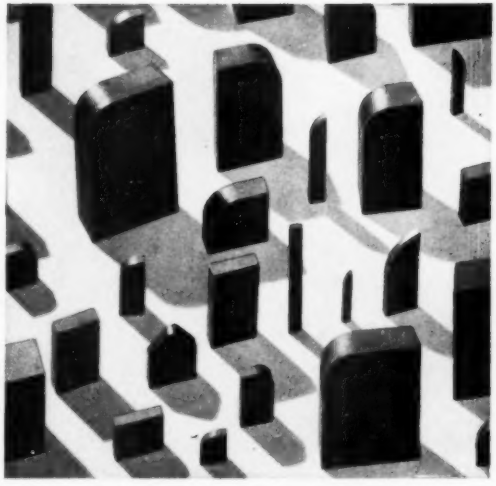
Carboloy's unique plan can bring you amazing results

AN AVERAGE saving in machining time of 40% sounds almost unbelievable! Yet that is only *one* of the many advantages this large eastern manufacturer gained from Carboloy's "Triple C" Plan (Coordinated Carbide Control).

With "Triple C" in action, this company found that tool inventories were more easily controlled, carbide tools were used more efficiently, and the cost of manufacturing specials tools was whittled down.

What does the company think of this plan? A company official says: *"We believe in Coordinated Carbide Control because the cost of cutting tools can be kept at a minimum through plant-wide standardization, it necessitates less equipment and personnel, and provides the best equipment and trained specialists."* And all supervision is sold on the benefits of "Triple C"!

This case is typical. Manufacturers, large and small, are finding that the "Triple C" Plan can keep down variable costs and help lower the all-important break-even point. If production machining of metal is a factor in your operation, it's a good bet that the Plan can produce the same kind of major savings for you. Write today for details. No cost, no obligation.



Carboloy standardization cuts tool costs! Typical, inexpensive standard blanks of Carboloy Cemented Carbide available from suppliers. Only 17 such blanks are required by this large company to tip 90% of their plant-manufactured tools!

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COORDINATED CARBIDE CONTROL
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CEMENTED CARBIDE

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MICROFLAT

Model 705-2
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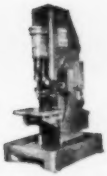
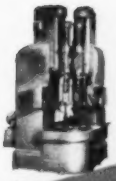


Model 720
HYDROHONER



Model 720-2
HYDROHONER

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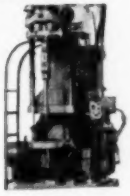
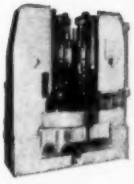
YOUR BEST MOVE *to cut your costs!*



GAGE BAR MICROSIZE
Single Spindle

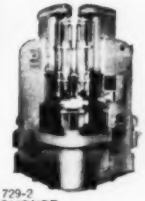


Model 726-3
HYDROHONER

Model 818
MICROFLAT

Model 718
HYDROHONER

GAGE BAR MICROSIZE
V-8 Multi-Spindle



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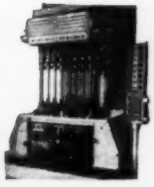
Our twenty years of honing progress have produced these machines which are cutting costs for many manufacturers. They can help cut your costs, too! Let's explore it!



GAGE BAR MICROSIZE
Multi-Spindle

Model 821-2
MICROFLAT

Model 604
HYDROHONER

Model 844-2
MICROFLAT

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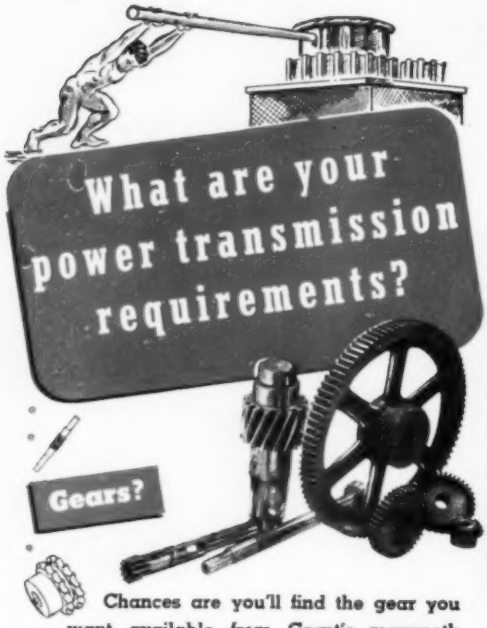
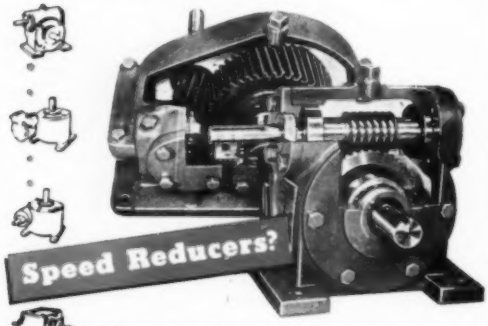


Chances are you'll find the gear you want available from Grant's mammoth stock. If not, complete facilities are available to cut all types. Deliveries made on your schedule. Write today for free catalog describing complete line.



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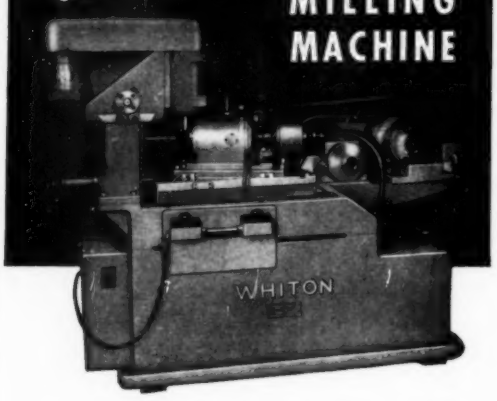
Whiton SPECIAL PURPOSE MILLING MACHINE



More pieces per cutter grind because special feed cam varies feed to maintain constant area of cut.

Faster output because cutter speed will run at 125 surface feet per minute with feed up to .003 per tooth.

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Easier operation because two buttons control the job. One button automatically chucks the work. Second button starts machine through cycle. Work holding head equipped with automatic work ejector.

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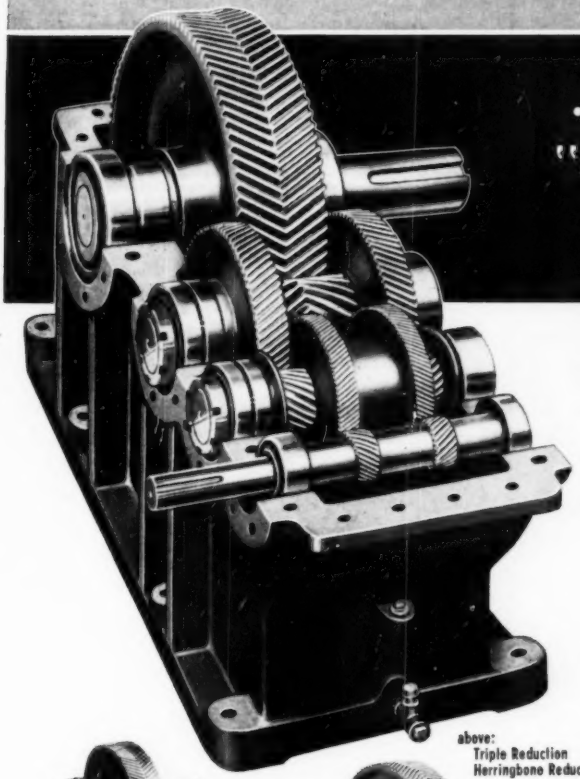
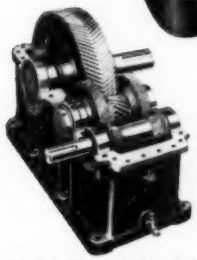
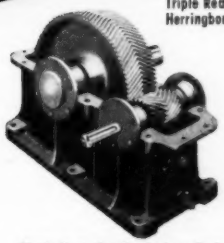


above:
Triple Reduction
Herringbone Reducer



Double Reduction Herringbone Reducer



Single Reduction Herringbone Reducer

. . and Bearings "Share the Load" *Equally*

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HERRINGBONE
Speed Reducers

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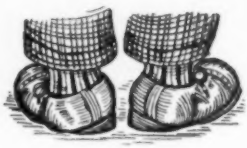

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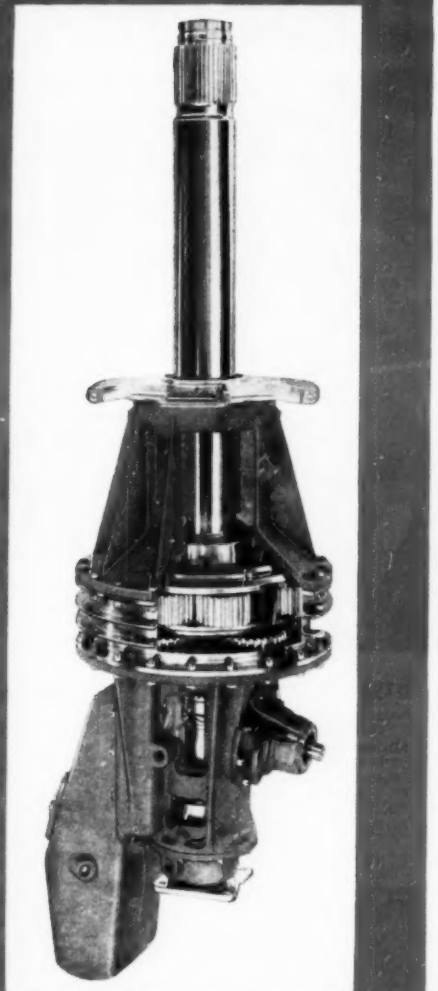

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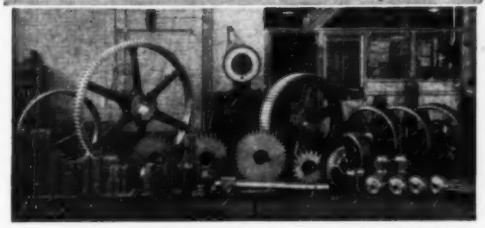

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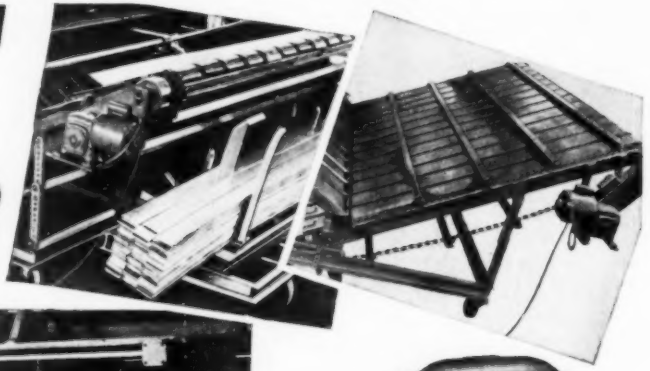

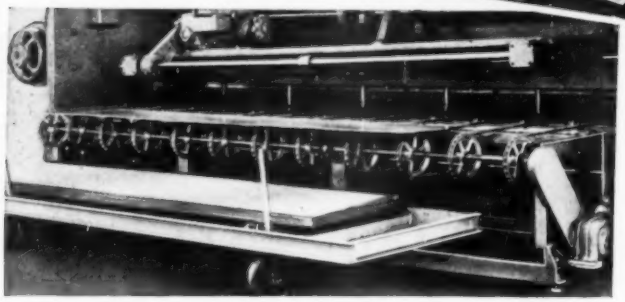

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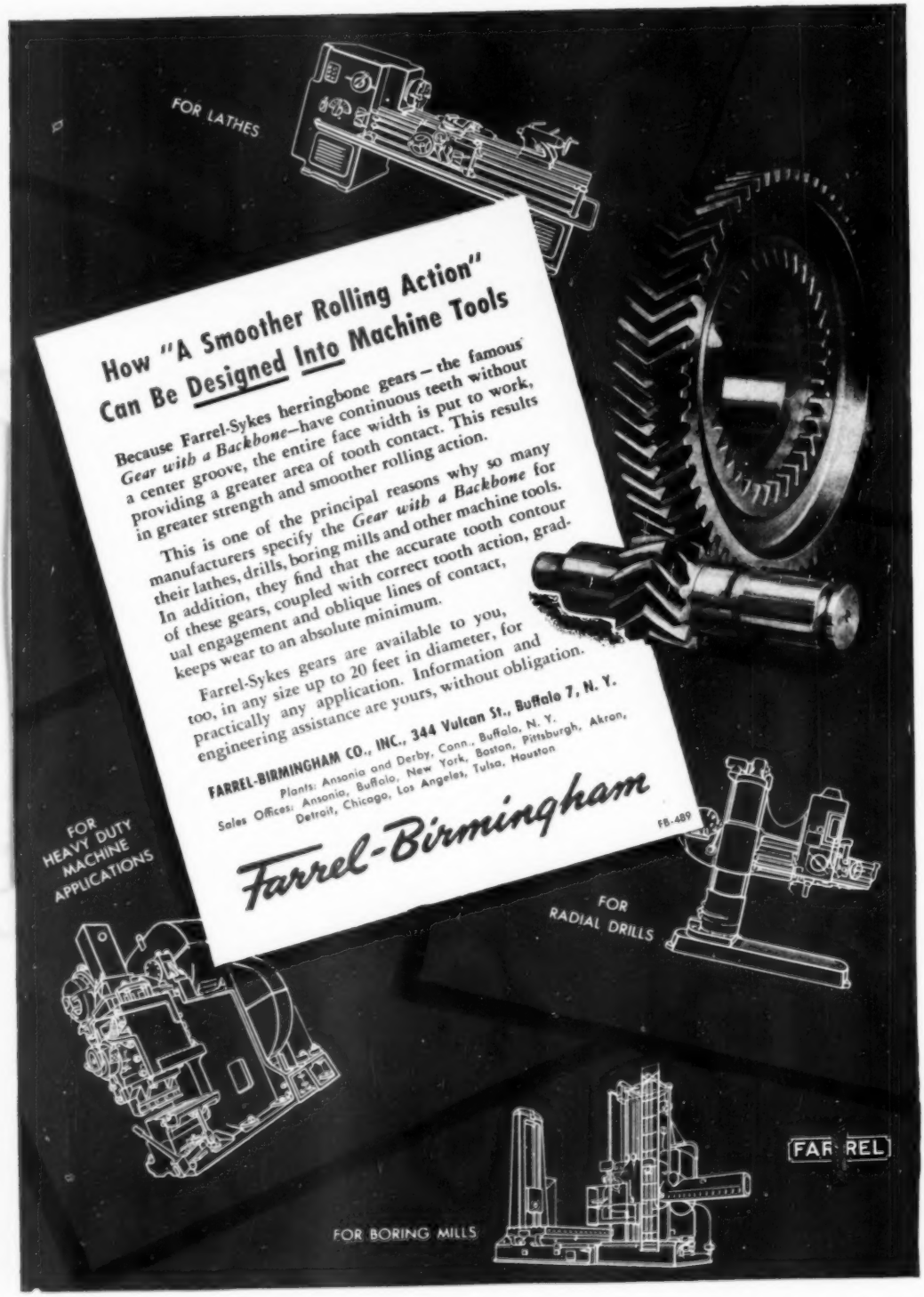
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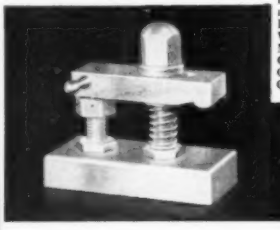
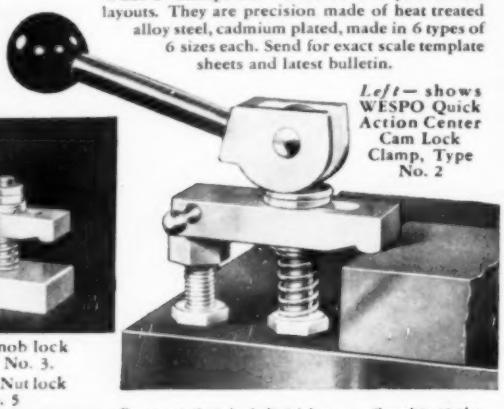
FIXTURE CLAMPS

WESPO also makes a complete line of over 350 types and sizes of fixture parts and fittings.

WESPO Clamps can be included in your fixture layouts. They are precision made of heat treated alloy steel, cadmium plated, made in 6 types of 6 sizes each. Send for exact scale template sheets and latest bulletin.

Above—End knob lock clamp. Type No. 3.
Below—Acorn Nut lock Type No. 5





Left—shows WESPO Quick Action Center Cam Lock Clamp, Type No. 2

Representatives in industrial areas. Complete stocks at factory and the following:

ROCHESTER, N. Y.	Rekers & Roessell
WICHITA, Kan.	Cummings & Co.
MILWAUKEE, Wis.	Triplex Supply Co.
CANTON, Ohio	Service Tool & Supply
CAMDEN, N. J.	Fidelity Tool Supply
CHICAGO, Ill.	J. R. Reinertson & Co.

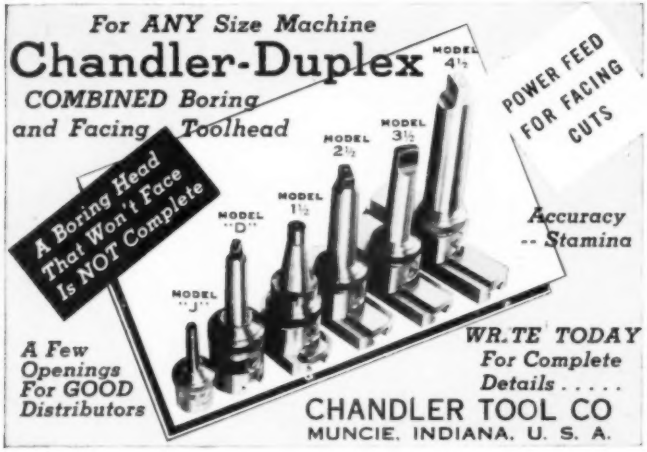
WEST POINT MFG. CO.
19631 Merriman Court
FARMINGTON, MICH.

For ANY Size Machine

Chandler-Duplex

COMBINED Boring and Facing Toolhead

A Boring Head That Won't Face Is NOT Complete



POWER FEED FOR FACING CUTS

Accuracy -- Stamina

A Few Openings For GOOD Distributors

WRITE TODAY For Complete Details . . . . .

CHANDLER TOOL CO
MUNCIE, INDIANA, U. S. A.

ECONOMIZE WITH

BACKED by 29 YEARS EXPERIENCE in ENGINEERING, DESIGNING and MANUFACTURING of BROACHES and BROACH FIXTURES

Troublesome Jobs our Specialty

- McPherson's Method of grinding spline broaches prevents friction and galling.
- Broaches and Broach Fixtures for TURBO JET MOTOR PARTS.
- Representatives in all Principal Cities.
- Engineering Service Rendered PROMPTLY

• LET US ENGINEER YOUR BROACH JOBS. No Broach too large, too small, or too complicated.

Performance Guaranteed

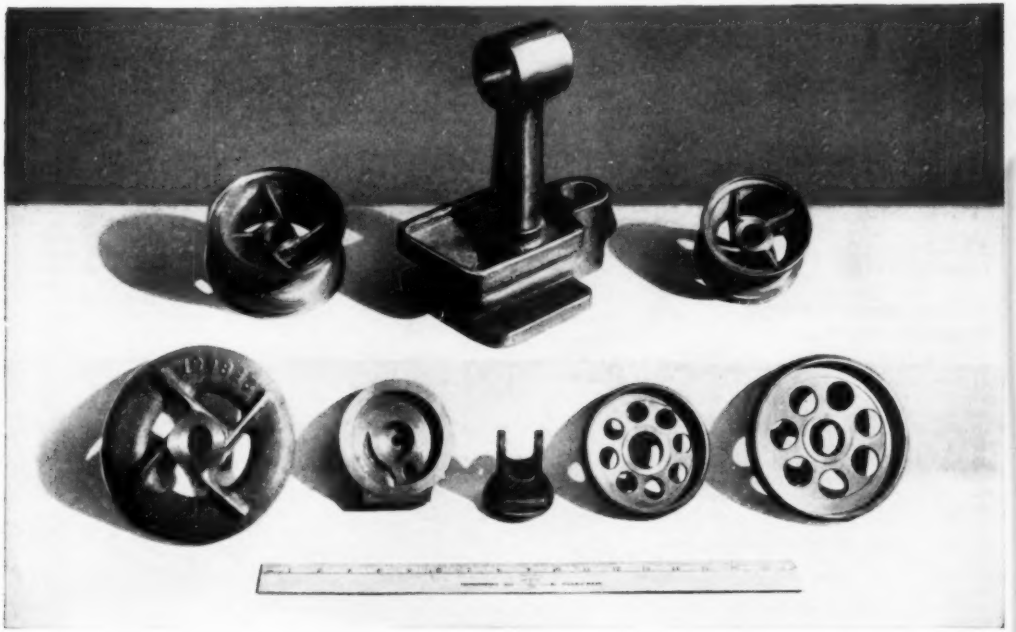
McPHERSON
Broach & Machine Co., Inc.
6234 Second Blvd., Detroit 2, Mich.

SPECIFY THIS POWERFUL, POSITIVE INNOCULANT

NISILOY*

to eliminate hard chilled areas in gray iron castings

. . . *REDUCE machining time, tool wear, rejections*



Produce *machinable* gray iron castings regardless of sharp variations in section thickness . . .

Eliminate localized hard areas or chilled (white) edges and surfaces . . .

Reduce machining time, tool wear and rejections . . . *raise both quality and quantity of your output by controlling gray iron structure with small ladle additions of NISILOY.*

Designed specifically to promote better machinability, NISILOY is a powerful innoculant and graphitizer containing about 60% Nickel, 30% silicon, balance essentially iron.

*Trade Mark of The International Nickel Company, Inc.

Mail the coupon now . . . for your *free* copy of a booklet that describes how Nisiloy helps you improve structure and machinability of gray iron castings.

EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC.
Dept. AM, 67 Wall Street, New York 5, N. Y.
Please send me your booklet entitled, "NISILOY" for GRAY IRON CASTINGS.

Name.....*Title*.....
Company.....
Address.....
City.....*State*.....

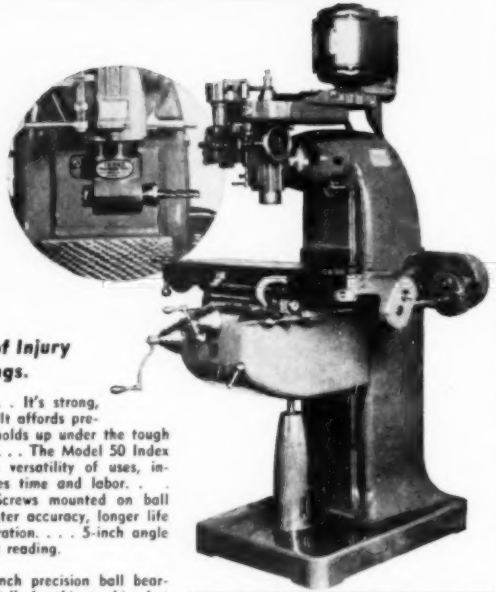
THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

"IT STANDS *the* GAFF!"

CAN YOU FLY-CUT WITH YOUR PRESENT VERTICAL MILLING MACHINE... ..AND THEN DO BORING...?

You Can with the Model 50 INDEX MILLING MACHINE

without Danger of Injury to Spindle Bearings.



It will stand abuse. . . . It's strong, rigid, streamlined. . . . It affords precision at low cost, yet holds up under the tough job of removing metal. . . . The Model 50 Index Machine offers a wide versatility of uses, increases production, saves time and labor. . . . Ground Thread Lead Screws mounted on ball bearings, make for greater accuracy, longer life and smooth, easier operation. . . . 5-inch angle faced dials provide easy reading.

ROTARY TABLE (12-inch precision ball bearing) is engineered especially for this machine but is suitable for practically all other milling machines as well. . . . Available either with Selector and Plates or equipped with dials graduated in minutes.

A RIGHT ANGLE MILLING ATTACHMENT further increases the versatility of this machine.

Write for Folder "50"

INDEX MACHINE CO.

547 N. MECHANIC STREET JACKSON, MICHIGAN

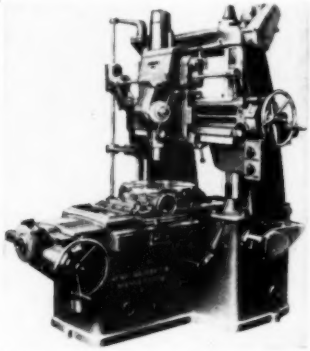
Only Reliable Products Can Be Continuously Advertised

WHY YOU SAVE MONEY 2 WAYS WITH THIS SWISS JIG BORER!

Check These Facts:

1 You *Step-up Production, Reduce Costs* and get a *Higher Quality Product with Finer Finish* because this borer is a *high-precision Swiss* machine. Its automatic features are capable of fine adjustment with highest possible accuracy. Result: increased production, a perfect finish to the closest limits, and longer life for the tools. But this is only one of the ways you save money!

2 You save money in *first cost* on this Swiss jig borer because you buy direct from this manufacturer. Not only is this important Swiss tool priced no higher than corresponding domestic tools, size for size and capacity for capacity, but, because this manufacturer maintains its own sales offices in the United States, many extra charges are eliminated, making it possible for you to obtain this precision Swiss jig borer at astonishingly reasonable cost.



Model 4C illustrated, with 18 spindle speeds from 45 to 2,000 R.P.M., provides the correct range for all jobs up to the maximum drilling capacity of 1½". Six automatic feeds of the boring spindle from 0.0005" to 0.0080" per revolution operate when rising and descending.

Positive Accuracy—Stabilized measuring screws of special heat treated steel, equipped with corrector bars to compensate for small pitch errors, assure positive accuracy of setting to 0.0002".

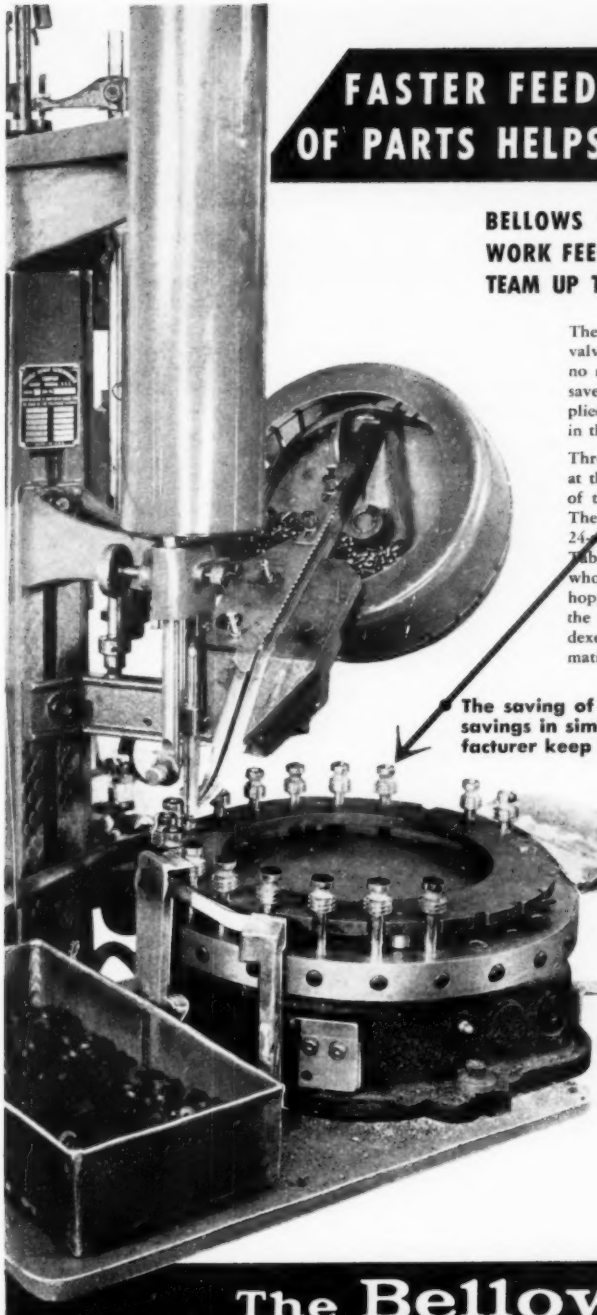
Write for data on this and other Hauser precision machines for quality and quantity production.

HAUSER DIVISION

HAUSER

MACHINE TOOL CORP.

MANHASSET, N. Y.



FASTER FEEDING AND EJECTION OF PARTS HELPS CUT COSTS 25%

BELLOWS "CONTROLLED-AIR-POWER" ROTARY WORK FEED TABLE AND BELLOWS AIR MOTORS TEAM UP TO MAKE HAND OPERATION AUTOMATIC

The cost of inserting the washer and screw in the valve stem of a water faucet isn't a major cost item, no matter how it's done. But a fraction of a penny saved here, a fraction of a penny saved there, multiplied by thousands of parts, adds up to major savings in the total cost picture.

Through the ingenious toolroom-built device shown at the left a mid-western manufacturer cut the cost of this operation 25% under the old method used. The operator loads the valve stem and washer in the 24-station Bellows Rotary Work Feed Table. The Table positions the part under a power screw driver whose spindle is fed by a Bellows Air Motor. The hopper-fed screw is driven to correct pressure, and as the screw driver retracts the Rotary Feed Table indexes to the next position. A third Air Motor automatically ejects the part.

The saving of 25% in this operation, coupled with like savings in similar production processes helps this manufacturer keep his favorable competitive position.

YOU, TOO, CAN CUT PRODUCTION COSTS WITH BELLOWS "CONTROLLED-AIR-POWER"

No matter what you make chances are good [illegible] your plant where Bellows Work[illegible]ds, Bellows Air Motors, Bellows [illegible]ling Devices, and other Bellows Controlled-Air-Power" Units can help you save important money.

Write for this

FREE BOOK

Or better yet, phone your local Bellows Field Engineer; ask him to bring you a copy of Bulletin CL-15. Let him show you how Bellows "Controlled-Air-Power" Devices are helping others beat the squeeze on profits.

The Bellows Co.

AKRON, OHIO

ATLANTA • BALTIMORE • BIRMINGHAM, MICH. • BOSTON • BROOKLYN • BUFFALO • CANTON • CEDAR RAPIDS, IA. • CHICAGO • CINCINNATI • CLEVELAND
COLUMBUS, O. • DAYTON, O. • DETROIT • GRAND RAPIDS, MICH. • HARTFORD, CONN. • HOUSTON • INDIANAPOLIS • MILWAUKEE • MINNEAPOLIS
MT. VERNON, N. Y. • NEWARK • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE • READING, PA. • ROCKFORD, ILL. • ST. LOUIS
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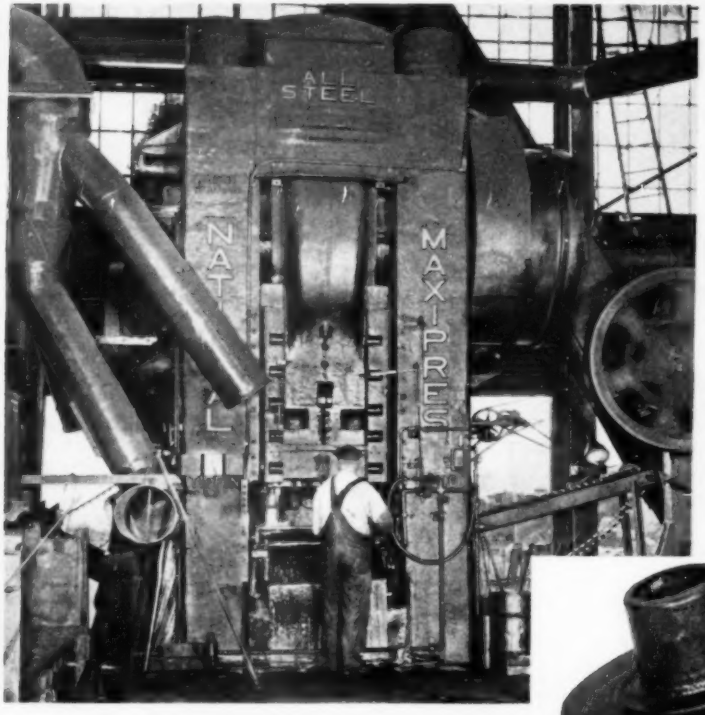
Automobile Wheel Hubs Forged at Rate of 450 Per Hour!

● The Automobile wheel hub forging illustrated below is forged by Lefere Forge and Machine Co., Jackson, Mich., on a National No. 6-A MAXIPRES, at an average rate of 450 forgings per hour!

The blanks are conveyed from the furnace to the MAXIPRES, which forges them in two blows to close tolerances, after which they are conveyed to the trim press. This intricate forging weighs seven pounds five ounces, with only a small amount of stock lost in the flash ring and slug.

Here is another example of how National MAXIPRESSES increase production rates, save costly material and produce superior forgings at lower cost.



75th Anniversary 1874-1949

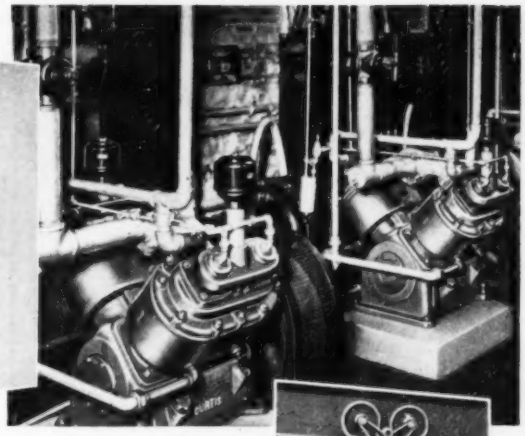
NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET, AND WIRE NAIL MACHINERY

New York Detroit Chicago

Reduce Production Costs with CURTIS

AIR COMPRESSORS, AIR HOISTS AND AIR CYLINDERS



Plant after plant is turning to Curtis Air Hoists and Cylinders for pushing, pulling, lowering or lifting operations . . . and to multiple installations of Curtis Air Compressors, which eliminate long air lines, the possibility of air leaks, and losses resulting from breakdowns of central air compressor installations.

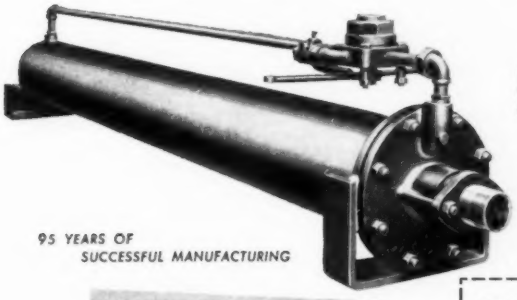
Here's why it will pay you to consider CURTIS *equipment*

AIR HOISTS AND AIR CYLINDERS

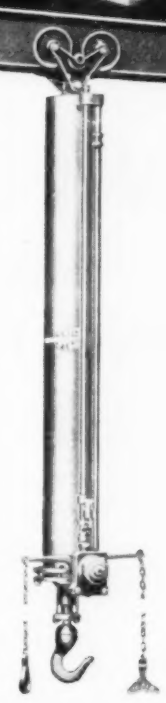
- Cannot be overloaded.
- Hoisting or lowering speed is controlled by operator.
- Ground-steel cylinder.
- Disc type valves.
- Valve automatically returns to vertical position when released.
- Can be operated by unskilled labor.

AIR COMPRESSORS

- Timken-Bearing equipped—permits external adjustment.
- Self oiling—positive lubrication.
- Precision construction throughout.
- Complete valve assembly removed or replaced in a few moments.
- Cylinder, crankcase, also heads made from gas-tight iron.
- Fully enclosed.



Curtis bracketed-type Air-Hoist Cylinder can be placed in any position from horizontal to vertical.



Curtis Pendant Air Hoist can be used for practically any lifting problem where the head room is not limited.

95 YEARS OF SUCCESSFUL MANUFACTURING

CURTIS

PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1924 Kienlen Avenue, Saint Louis 20, Missouri

Curtis Pneumatic Machinery Division of Curtis Mfg. Co. 149-4
1924 Kienlen Avenue, St. Louis 20, Missouri

I am interested only in items checked below:

- ☐ Air Hoists
- ☐ Air Cylinders
- ☐ Air Compressors

NAME _____
FIRM _____
STREET _____
CITY _____ ZONE ____ STATE _____

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WELDON

Stub Length Double-End End Mills

NEW!—Stock Items

A new line of small double-end end mills, with flutes shorter than regular, offer these advantages:

GREATER STRENGTH
LONGER TOOL LIFE
FAR LESS BREAKAGE
FASTER FEEDS

Same high Weldon quality in 2- and 4-flute styles.

For complete list send for Folder No. STM-1

THE WELDON TOOL CO. Cleveland 4, Ohio
3000 WOODHILL ROAD

ACCURACY
Efficiency
Economy

These three factors are the key-note of our special tools and machinery. Columbus Die-Tool builds and designs the tool for your particular purpose and will solve the toughest tooling problems effectively and promptly. Do not hesitate to consult us, our experience in this field is most comprehensive.

JIGS • FIXTURES • SPECIAL TOOLS
BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
PUNCHES AND DIES

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& Wand Machine Co.
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ABRASIVE
SURFACE GRINDERS

ABRASIVE MACHINE TOOL CO., EAST PROVIDENCE 14, R.I.
AGENTS IN PRINCIPAL CITIES

BAUMBACH *The* BEST IN DIE SETS

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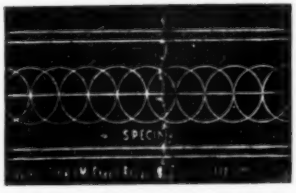
Being originators of Standard Die Sets naturally we are steps ahead in Design—Precision—Dependability and Economy. Because Baumbach Die Sets have demountable Leader Pins and Bushings, Die Set inventory is reduced as well as costly machining time. Learn about Baumbach superiority before you buy.

E. A. BAUMBACH MFG. CO., 1194 S. Kilbourn Ave., Chicago 23, Ill.

DYKEM STEEL BLUE

STOPS LOSSES
making dies & templates



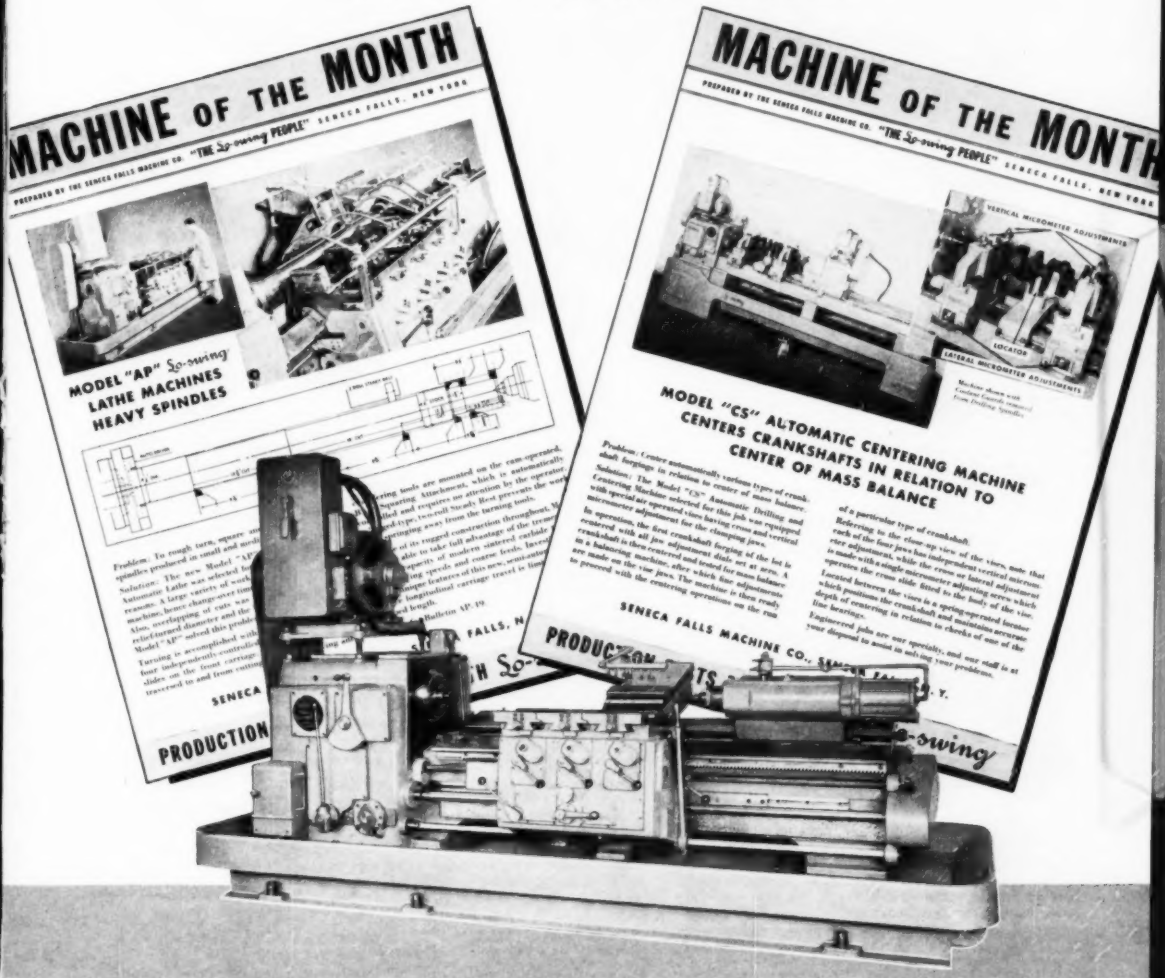
Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2301 B North 11 St., St. Louis, Mo.
In Canada: 2400 Dundas St. West, Toronto, Ont.

HOW DO YOU MEASURE OBSOLESCENCE?

Never lose sight of the fact that your cost must be as low as your competitor's if you expect to stay in business.

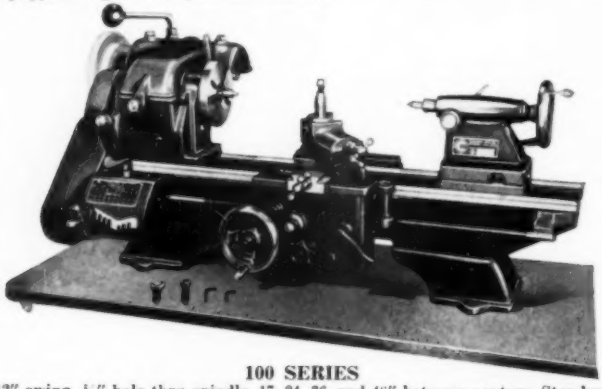

MACHINE OF THE MONTH
PREPARED BY THE SENECA FALLS MACHINE CO. "THE So-swing PEOPLE" SENECA FALLS, NEW YORK
MODEL "AP" So-swing
LATHE MACHINES
HEAVY SPINDLES
PRODUCTION
MACHINE OF THE MONTH
MODEL "CS" ALTOMATIC CENTERING MACHINE
CENTERS CRANKSHAFTS IN RELATION TO
CENTER OF MASS BALANCE
SENECA FALLS MACHINE CO.

Age, by itself, is only a fair measuring stick for obsolescence. A machine tool is obsolete, when replacement by a new machine, offering production economies, will pay a substantial dividend on the net investment. Many relatively new machines are now obsolete because more efficient ones have been developed that will outproduce them at lower cost. In the last six months Seneca Falls has announced new machines which, in specific cases, are paying for themselves out of savings over methods which were *efficient* 12 months ago. ● Seneca Falls Machine Co., Seneca Falls, N. Y.

Clausing Precision Lathes

200 SERIES

12" swing, 1⅛" hole thru spindle, forged spindle with L-00 Long Tapered Spindle Nose, Headstock enclosed, running in oil, gear box enclosed, running in oil, outboard drive providing maximum belt pull, easy belt changing. Optional variable speed drive. 24", 36" and 48" between centers. Timken Bearing equipped. Single lever apron feed control.



100 SERIES

12" swing, ¾" hole thru spindle, 17, 24, 36, and 48" between centers. Standard and quick change models. Optional clutch in counter shaft for stopping and starting lathe while motor keeps on running. Low in price, ruggedly built, ample range. Timken Bearings.

Clausing Lathes are widely used in toolrooms, maintenance and experimental departments, production, wherever there is turning to do. If you contemplate the purchase of a lathe you will not be serving your own interests adequately if you do not investigate all that Clausing Lathes have to offer. The integrity of the company behind them is your assurance that you can buy Clausing Lathes with confidence.

Since 1931

CLAUSING MANUFACTURING CO.

227 RICHMOND AVENUE — OTTUMWA, IOWA

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☐ 200 SERIES LATHES ☐ 100 SERIES LATHES

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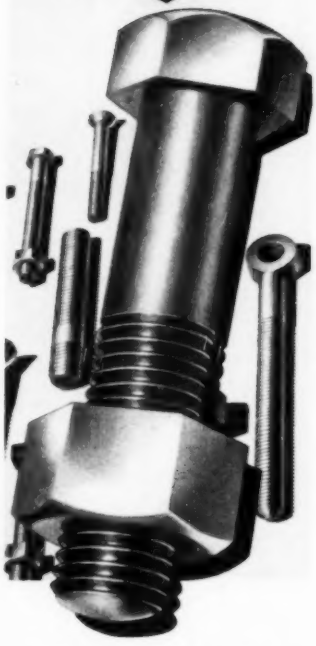
First for
BOLTS
NUTS
STUDS



★ Carbon Steel ★ Stainless Steel
★ Heat-treated ★ Silicon Bronze
Alloy Steels ★ Naval Brass
★ Monel Metal

You can count on a uniform Class 3 Fit when you buy Pawtucket threaded fasteners. Accurately made in standard dimensions — or to your specifications.

BETTER BOLTS SINCE 1882

Use Headed and Threaded Fasteners for Economy and Reliability

PAWTUCKET

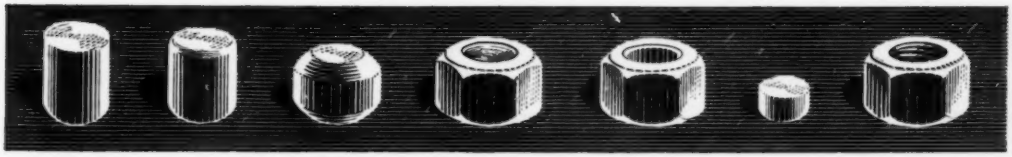
"THE BOLT MAN"

MANUFACTURING COMPANY

327 Pine Street · Pawtucket, R. I.

THE PLACE TO SOLVE YOUR BOLT PROBLEMS

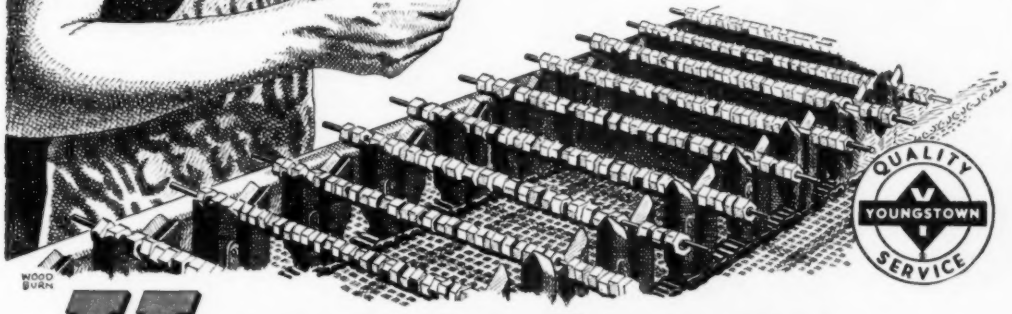
T.M. REG.



For Minimum Rejects

FROM first to last, nuts formed from Youngstown Scrapless Nut Quality Wire stand strict inspection--by magnetic particle or the usual visual inspection methods. That's because Youngstown Scrapless Nut Quality Wire comes to you so free from piping, seams, laps, die marks, internal tearing and cupping and nonmetallic inclusions.

Available in various compositions including AISI standard as well as special sulphurized steels. Cold heading bolt wire, of comparable quality, in all standard carbon analysis available for prompt shipment to the bolt and nut industry.



QUALITY YOUNGSTOWN SERVICE

Youngstown

SCRAPLESS NUT QUALITY WIRE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

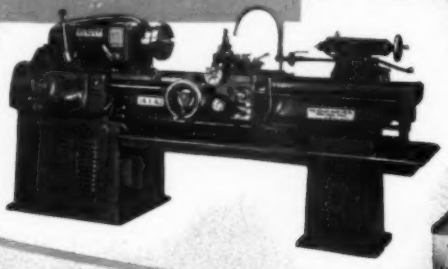
Export Office-500 Fifth Avenue, New York

WIRE · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · PIPE AND TUBULAR PRODUCTS · HOT AND COLD FINISHED CARBON AND ALLOY BARS · RODS · SHEETS · PLATES · CONDUIT · RAILROAD TRACK SPIKES.

. . . If you are not using you are not earning the

are you using this modern equipment?

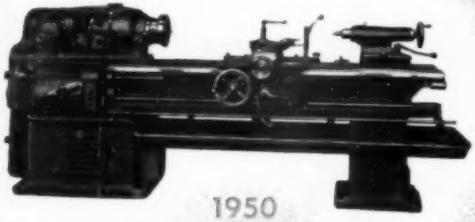
1950
No. 2
GENERAL PURPOSE
LATHE



New! Has all the facility of the Cone Head Lathe, but has built-in motor and single lever belt shifter. Unique feature eliminates belt pull on spindle. 8 spindle speeds and 48 thread and feed changes. Cam lock or long taper key drive spindle noses. Spindle is graduated to permit indexing for multiple threads. Preloaded, super-precision spindle bearings. Automatic lubrication. Swings 16" and available in wide variety of bed lengths. Bed ways, both carriage and tailstock, are hardened and precision ground.

THE HENDEY MACHINE CO.
HARDENED AND GROUND BED WAYS

COMPARE



1950
12- AND 18-SPEED GENERAL PURPOSE
ENGINE & TOOL ROOM LATHES

Like all Hendey Lathes, the bed ways, both carriage and tailstock, are induction hardened and precision ground. Every important unit has automatic lubrication. Rear end of spindle is graduated for indexing when cutting multiple threads, and there are 36 thread and feed changes. Precision, all-geared headstock powered from built-in motor in cabinet leg. Spindle speed ranges from 19-1000. Cam lock or long taper key drive spindle noses. Hendey Tool Room Lathes available with swings of 9", 12", 14", 16", 18", 20" and 24".

COMPARE

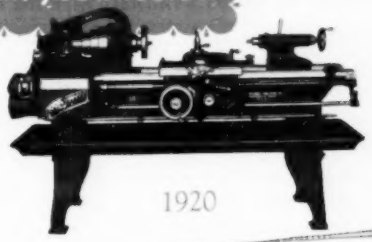
1950 12" UNIVERSAL
CRANK SHAPER

On the Hendey 12" Universal Crank Shaper, standard equipment *includes* table and vise for positioning and indexing work to any angle. You also get flanged mounted motor, mechanical controls on both sides, automatic lubrication, quick-change swivel head, adjustable, preloaded Timken bearings on the bull gear, plus many other features usually considered "extra". The Hendey 12" Crank Shaper is finished like a fine watch, both inside and out. Here is an accurate, fast money-maker for tool room and production work. Also available in capacities from 16" to 28", both standard and heavy duty.

COMPARE

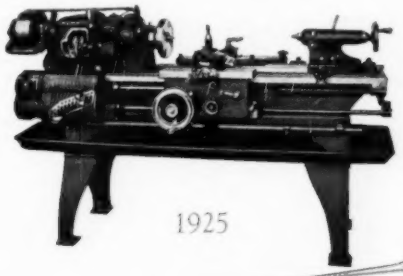
Modern Hendey Machines profits that you should!

. . . or are you earning less than you should?



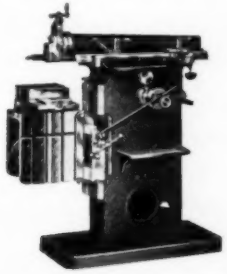
1920

Thousands of these Hendey Cone Head Lathes are still in use throughout the world. Compare the performance of these as against the new No. 2 General Purpose. The old Cone Head has overhead, manual belt shifting. Belt pull is direct on spindle from countershaft drive or motor on bracket. Top speed is 465 R.P.M. Bed is hand scraped, soft cast iron. A wonderful machine in its day, but not adequate for today's needs. How many of these in your shop? . . . losing money!



1925

This 8-speed Hendey Engine Lathe has long been obsoleted by the all-new Hendey 12- and 18-speed lathes. The bed is not hardened and precision ground. Maximum spindle speed is only 426 R.P.M. Although a masterpiece of design and construction in its day, the 8-speed has been replaced by progressive manufacturers, because the 12- and 18-speed offer every modern improvement necessary to earn maximum profits.



1920

Still using 15" Hendey friction drive shapers? They have only 2 speeds, 21 and 30½ strokes per min., as against 8 speeds from 14–200 for the new 12" shaper. Surveys prove that the new 12" Universal High Speed crank shaper covers a majority of all jobs in most plants. Mechanical changes are almost too numerous to mention – improved accuracy, speed and profits on the new 12" shaper will easily convince you of the advisability of changing *now!*

Continuous, advanced engineering by Hendey is worth watching – and *must* be watched if you are to continue to earn full profits from your lathes and shapers. For complete particulars and prices, contact your nearest Hendey office.

MODERN Hendey

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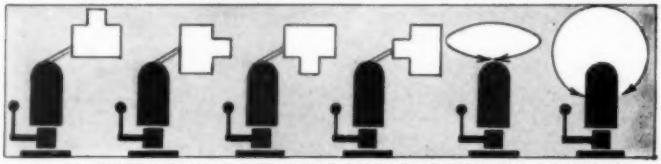

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Many plants have found that profits can be increased through the proper application of multiple or single operation special machine tools. Where production is moderate, several operations can be performed on one machine at lower costs than with a battery of standard machine tools. Where production is extremely high, a single purpose machine is often the only solution to the job at hand.

SPECIAL MACHINES WITH STANDARD ELEMENTS LOWER MACHINE INVESTMENT

Special machines, designed to suit a specific production method prove more practical investments for metalworking plants when they are assembled from standard machine elements. Davis and Thompson special machines are of this type. The two machines shown in the advertisement to the right are good examples of special machines utilizing standard elements.

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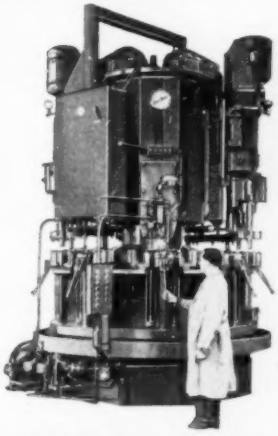
is maintained to assist you with machining production problems. Over thirty years of experience in the design and construction of machine tools enables us to offer you a wide selection of drilling and milling production machines. Take advantage of this special engineering service. There is no obligation. *Write* DAVIS AND THOMPSON COMPANY, Milwaukee 14, Wisconsin.

How to Combine Machining Operations in Less Floor Space

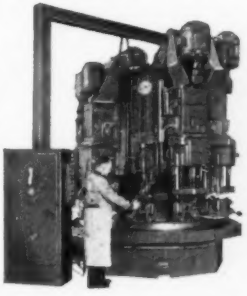
Here are two interesting examples of high production machining in relatively small floor space. Rather than string each operation out in a long line with conveyors, the operations are performed in fixtures held on a rotary indexing table.

5 OPERATIONS ON 240 PARTS PER HOUR IN 79 SQ. FEET...



This type VSI vertical indexing drilling machine is designed for drilling, reaming and chamfering five bolt holes and drilling and chamfering one 18" hole in automotive rear axle.

4 OPERATIONS ON 130 PARTS PER HOUR IN 84 SQ. FEET

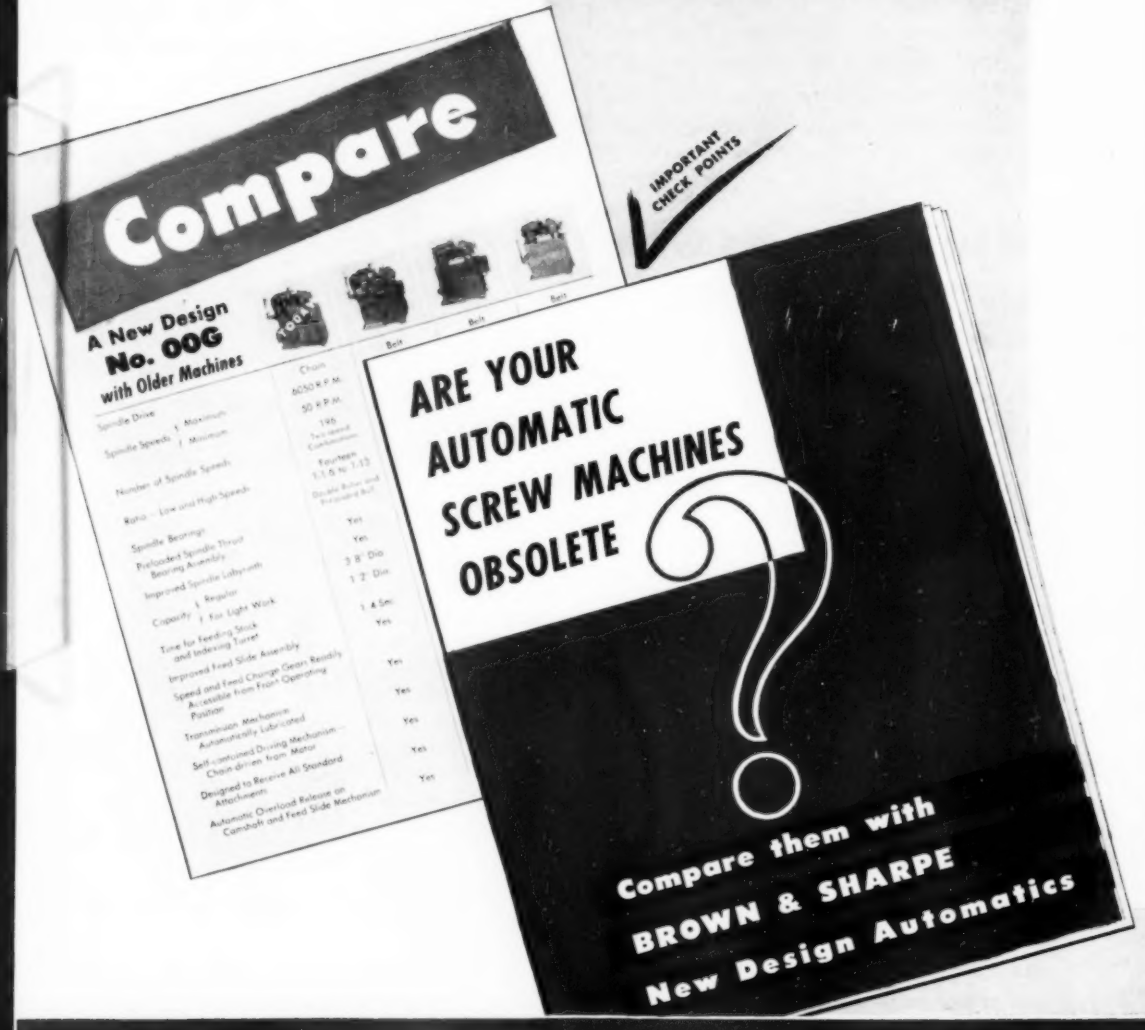


This type VSI special vertical automatic indexing machine is provided with eight two station fixtures for holding one each right and left hand spindle assembly supports. Operations include drilling, reaming, chamfering and sawing. While each head is hydraulically actuated, on the machine illustrated, electrical mechanical heads are also available.

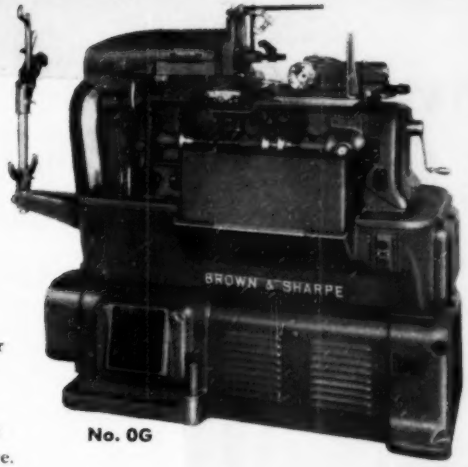
Write for free additional information today.
Ask for bulletin 160.

DAVIS and THOMPSON CO.
MANUFACTURERS OF *Machine Tools*
MILWAUKEE 14, WISCONSIN

See why today's AUTOMATICS are much more productive than older models



BROWN &



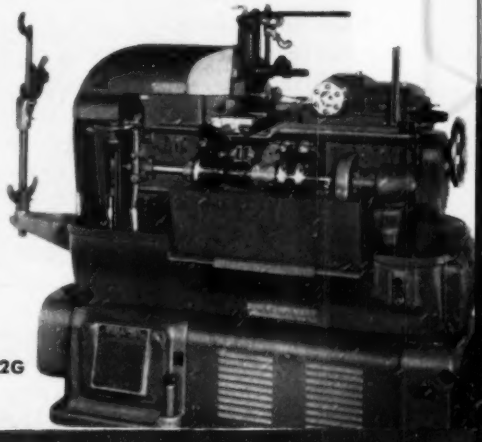
No. 0G

Maximum production per hour from every machine tool in your plant is more essential than ever, as today's conditions become increasingly competitive.

The new Brown & Sharpe Bulletin at the left shows how you can gain by replacing older automatic screw machines with those that embody the very latest features in design and construction. Features of today's Brown & Sharpe models and previous models, in chart form, make comparisons easy . . . fast . . . positive.

Send for your copy of this handy, helpful bulletin and guide, "Are Your Automatic Screw Machines Obsolete?" It covers the facts that you would ordinarily collect and correlate before making an investment. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

No. 00G



No. 2G

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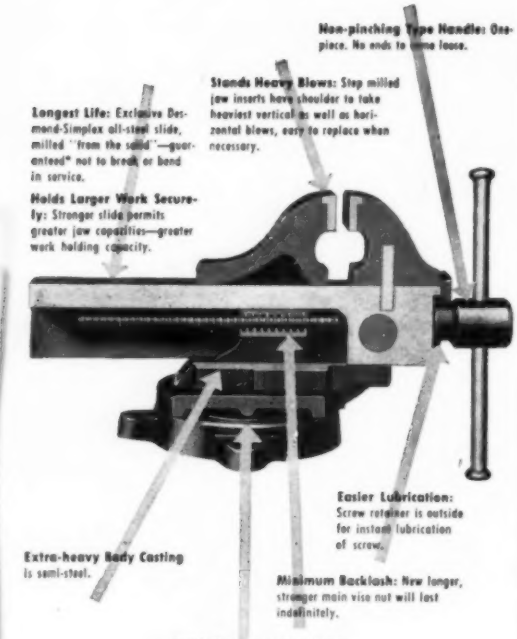
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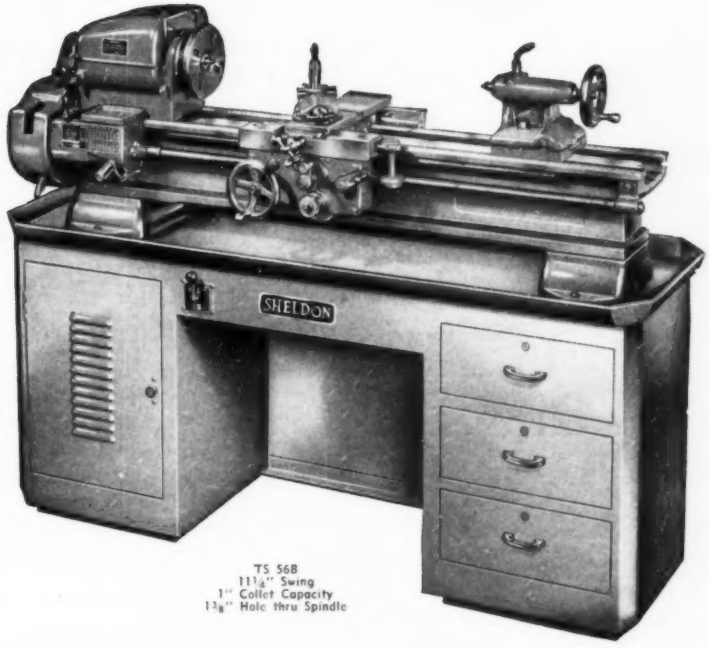

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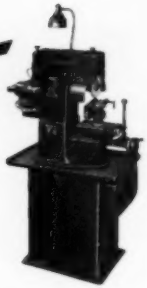

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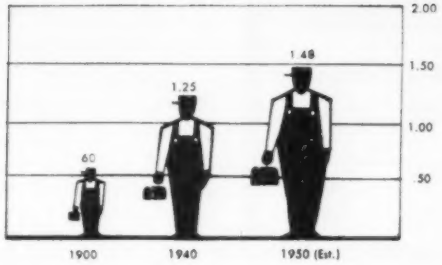
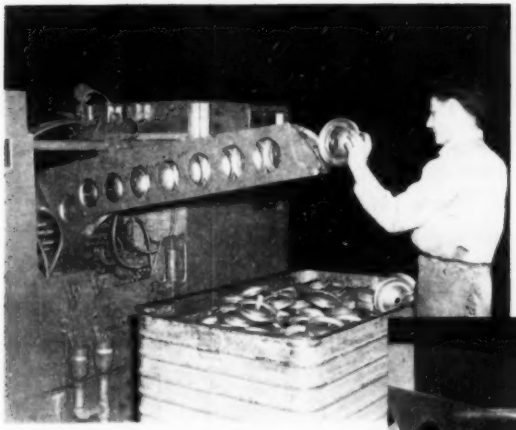
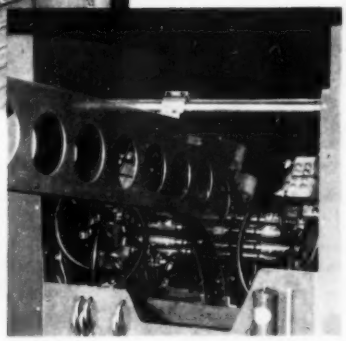


The basis of our well-being has always been closely allied with the *value of goods an hour's work will buy*. As the chart shows, this value has increased from 60c worth of goods in 1900 (at today's prices) to an estimated $1.48 worth in 1950. This value is bound to increase, and smart manufacturers know that *their* prosperity as well as the country's, depends upon their ability to produce more goods per man-hour expended.

here's how one manufacturer boosted production per man-hour eight times!





One of the world's largest producers of wheeled toys was faced with the problem of speeding up assembly of wheels. The assembly involved fastening two stamped wheel halves with 8 spot welds.

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Thus, only one operator welds more than 8 times as many wheels as formerly produced. Here is an instance where skilled use of resistance welding greatly *increased production* and *decreased unit cost*. For a complete description of this machine write for Bulletin No. 25A.

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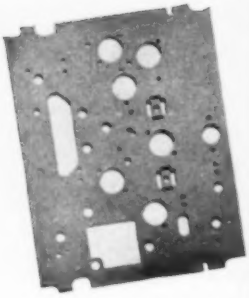
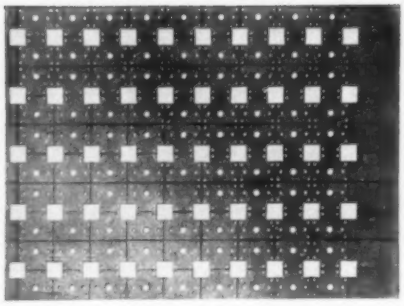


PIERCING TIME PER PIECE AS SHOWN

3 min. 50 sec.

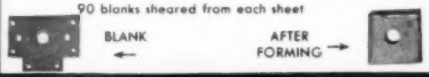
Complete lot of 500
2 Handling Operations
Size 8⅝" x 10½" x .047 steel

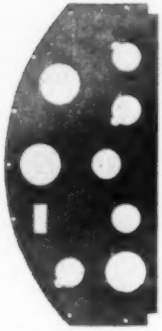


PIERCING TIME PER PIECE AS SHOWN

25 min. 48 sec.

Complete lot of 21
One Handling Operation
Size 17⅜" x 24" x 16 ga. cold rolled steel
90 blanks sheared from each sheet

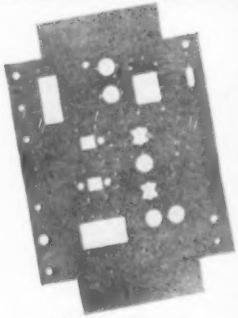




PIERCING TIME PER PIECE AS SHOWN

1 min. 53 sec.

Complete lot of 20
One Handling Operation
Size 18" x 38" x ¾" steel



PIERCING TIME PER PIECE AS SHOWN

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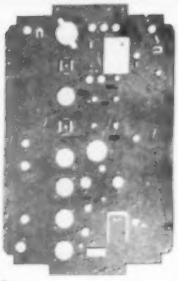
Complete lot of 200
1 Handling
Size 13⅜" x 20⅛" x .047 steel

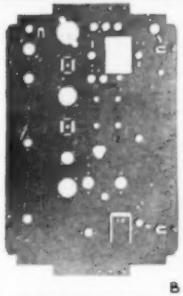


A

PIERCING TIME PER PIECE AS SHOWN

6 min. 28 sec.

Lot of 176
3 Handling Operations
Size 8⅞" x 14" x .047 steel



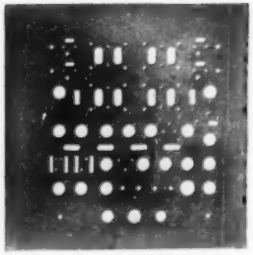
B

PIERCING TIME PER PIECE AS SHOWN

5 min. 43 sec.

Lot of 1374
3 Handling Operations
Size 8⅞" x 14" x .047 steel

Panels A and B are somewhat similar. After producing 176 pieces of panel A, engineering changes were made and incorporated in template changes. Production was completed on Panel B.



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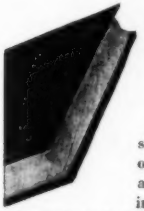

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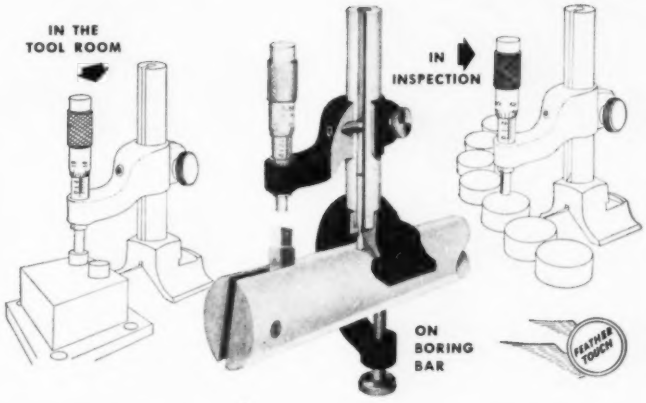

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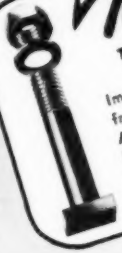

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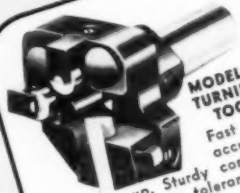

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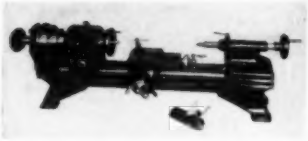

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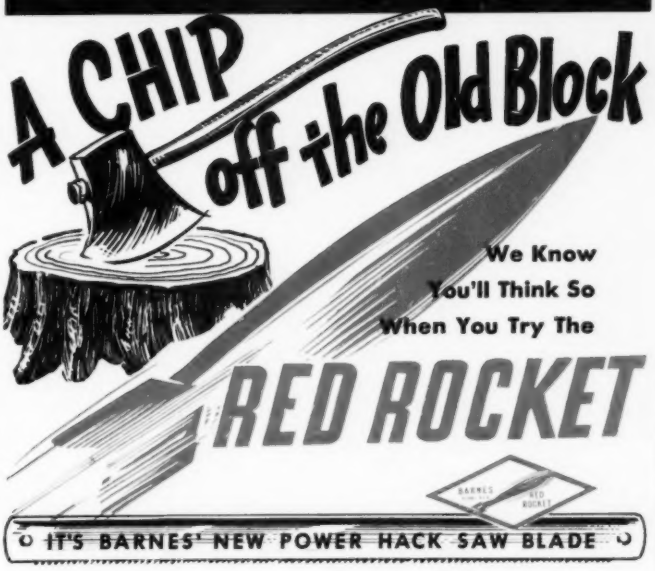

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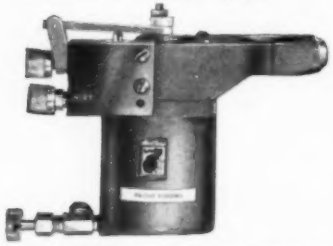

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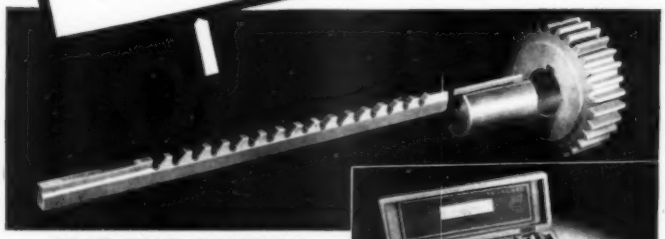

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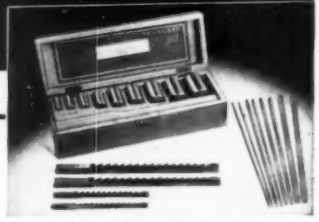

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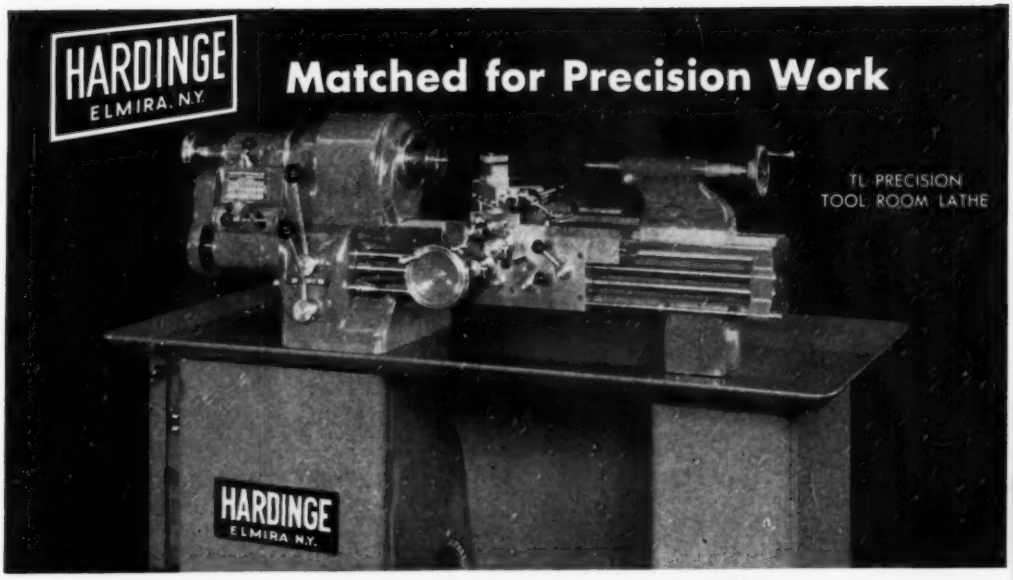

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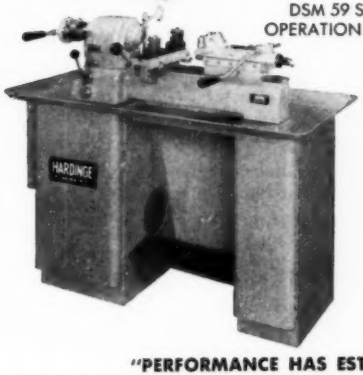

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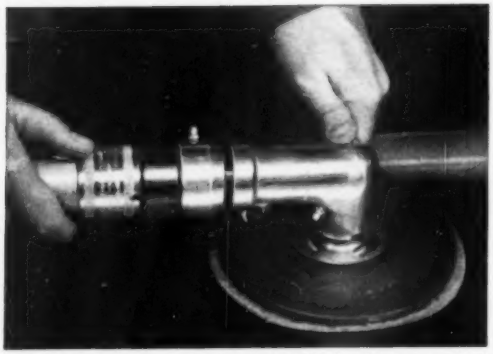
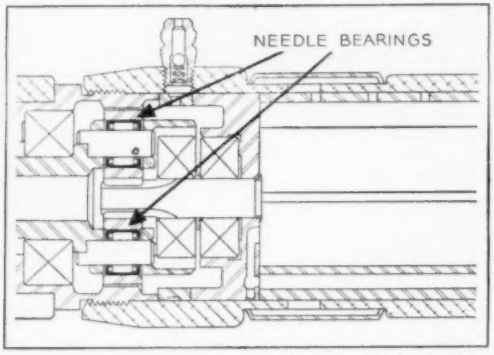


By Applying Torrington Needle Bearings in the planetary gears of the Model 7099 Screwdriver and Model 7095 Sander, Aro Equipment Corporation, Bryan, Ohio, increased power output 10%. This increase in efficiency, determined by special tests, is accompanied by reduced lubrication and maintenance, and longer service life.



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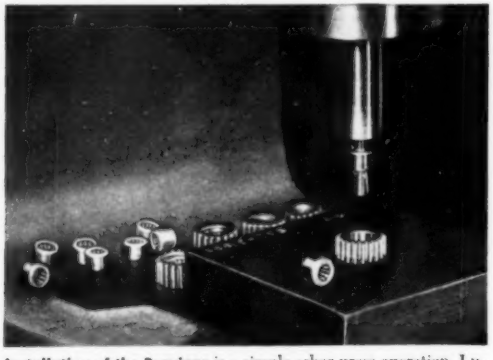

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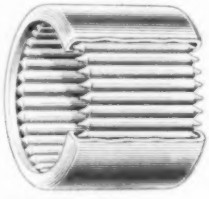

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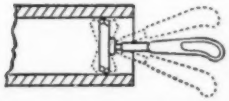

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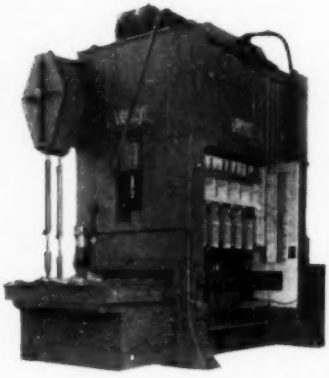

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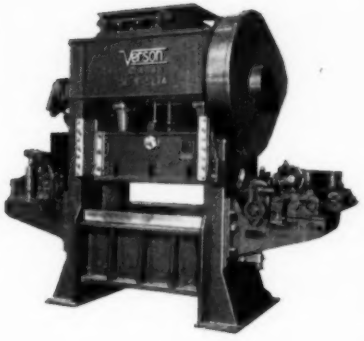

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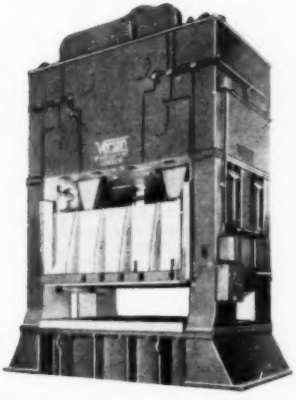

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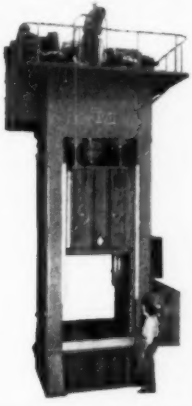

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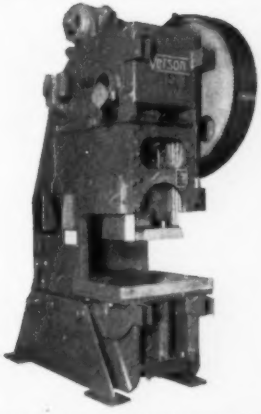

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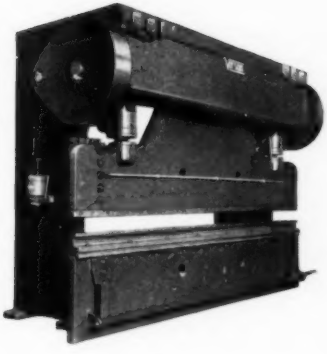

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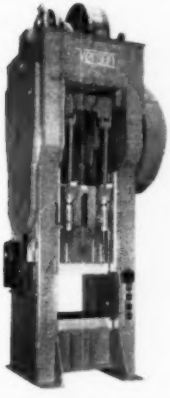
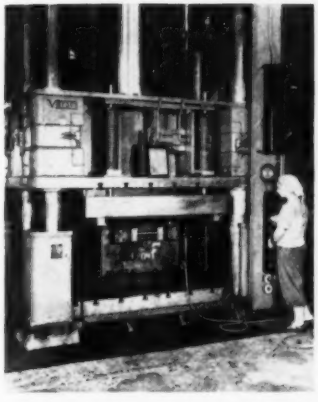


Verson Double and Triple Action Presses offer remarkable opportunities for economical production.



Verson Compression Molding Presses bring the advantages of Verson design to high pressure plastics molding.

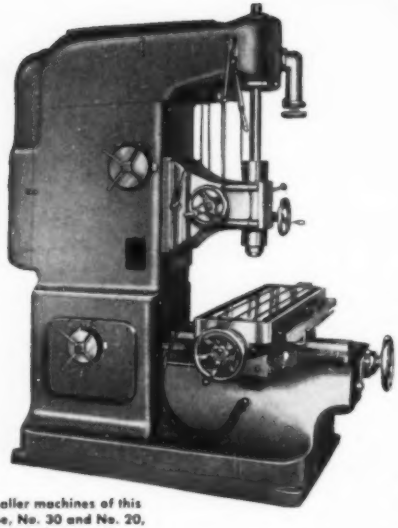
JOB FROM 60 TONS UP!

Here May Be Your Answer To

KNIGHT EQUIPMENT OFFERS

For Savings In Manhours And

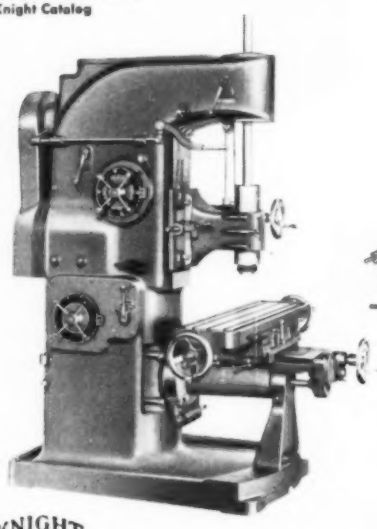
Here are machines noted for their speed, accuracy, versatility, simplicity and ease of operation —single precision-engineered units that can do the work of two or more special purpose machines but which demand a far lower initial investment —machines which have won such an outstanding



Smaller machines of this type, No. 30 and No. 20, are also shown in the Knight Catalog

No. 40
MILLING & PRECISION BORING MACHINE

A fast, versatile, powerful universal machine for both large and small jobs. Its tilting, swiveling table makes the use of expensive special jigs, angle plates or other fixtures unnecessary. 16 Table and spindle feed changes plus 4 vertical spindle feeds offer the most efficient use of small and large tools and cutters. One-piece column, wide bearing surfaces and precision gearing promise the most in accurate, effortless operation. Easy-to-reach controls for table direction, speeds and feeds — quick cutter changes at spindle nose — direct-reading speed and feed change dials — are only a few of the features that provide more efficient precision milling and boring.



No. 50
PRECISION BORING & VERTICAL MILLING MACHINE

A single solid base, fast, accurate machine of large capacity. Eliminates extra setup time and unnecessary work transfers. Exceptional cross and longitudinal table travel, large throat capacity plus long spindle travel provide a working range far greater than other machines of comparable size. Solid bed type construction for fast, heavy cutting — convenient controls — a complete range of feed and speed changes — all offer every opportunity to lower costs and raise profits.

KNIGHT VERSATILE MILLERS ACCURATE - RIGID

MORE GOODS for MORE PEOPLE

Lower Costs & Higher Output!

UNUSUAL OPPORTUNITIES!

Money, Plus Improved Quality

reputation for performance during 40 years of service that 66⅔% of all orders for Knight Equipment come from present users!

Knight Equipment can help you — to conserve labor — eliminate lost motion — lower unit costs — raise production. Write today for information!

20"
ROTARY TABLE
for Rotary Milling & Indexing

A self-contained motor-driven unit for use on any milling machine or horizontal boring mill. Eliminates all setup time. Operates off nearest electric outlet. No other equipment or connections required. Special geared-down motor provides ample power for almost any milling job. Eighteen quick feed changes from 1½" to 54" or 3" to 108" per minute. Automatic positioning and feed cycle are optional. May also be used wherever an automatic revolving fixture would save time and labor.

ELECTROMILL

A heavy duty vertical milling, drilling and boring machine for handling a wide range of large capacity work. Design permits elimination or inclusion of many features, speeds and feeds to meet any special requirement. Extra heavy table and saddle travel on rollers for easy operation. Deep throat provides exceptional capacity — long spindle bearings assure extra accuracy. Gearless smoother drive — complete machine controlled from a single panel that can be positioned for most convenient operation — safety features to protect work and operator — plus other fine engineered features offer a real investment in cost-cutting.

HOLE GRINDING ATTACHMENT

Accurately and quickly enlarges, straightens and finishes holes in heat-treated and hardened parts. Simplifies grinding work too large to swing in standard machines. Grinds holes in material too tough for smooth boring. Special adaptors permit installation on any milling or boring machine. A real time and labor saver.

W. B. KNIGHT
MACHINERY COMPANY
3920 WEST PINE BLVD. ST. LOUIS 8, MISSOURI

at LOWER COST

Mail This Coupon
FOR MORE INFORMATION

Attach to company letterhead

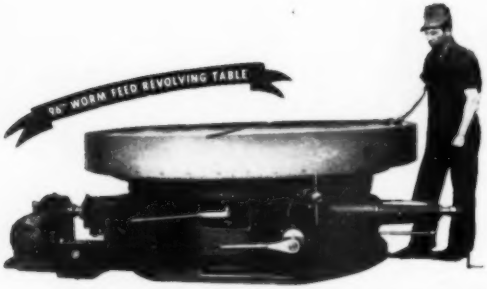
W. B. Knight Machinery Co.
3920 West Pine Blvd.,
St. Louis 8, Missouri.

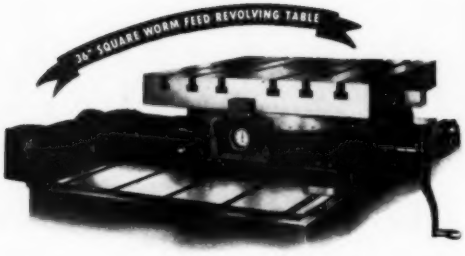
Send complete details and prices on the following Knight Equipment:

_____

Name _____

Title _____





BUILD YOUR PRODUCTION

OHIO STEP UP PRODUCTION

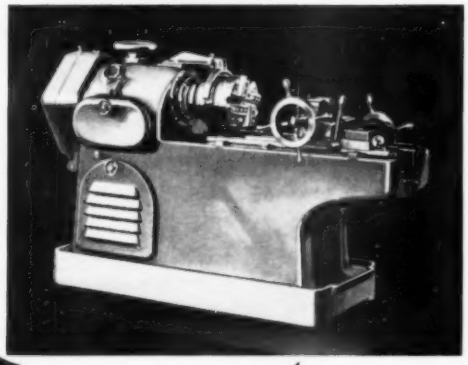
. . . for greater output

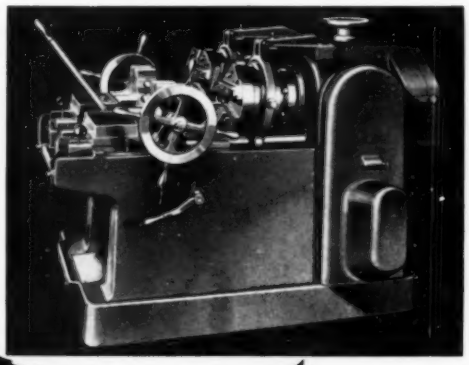
OHIO Revolving Table units were designed primarily for use on table and floor type horizontal boring mills but are also adaptable to other types of machine tools. Available in both round and square models depending upon your requirements and with or without power rapid traverse.

OHIO-MURCHEY Roller Pipe and Tube Cut-off Machines provide economical units for efficient pipe and tube cutting operations. The machine shown is arranged for adjustable air feed to cutter wheel. Hydraulic feed is also available as well as hand operated units.

OHIO-MURCHEY Threading Machines are furnished in two models—No. 11 and No. 22—either single or double head. The No. 11 machine has a capacity from ¼" to 1½" U.S.S. and S.A.E. threads—⅛" to 1¼" pipe threads. No. 22 from ½" to 2½" S.A.E. and U.S.S. threads—½" to 2" pipe threads.

OHIO DREADNAUGHT Shapers are modern, accurate, efficient machines of rigid construction with plenty of power to meet the exacting requirements of tool rooms and machine shops. Available in all sizes from 16" to 36" with a complete range of attachments, these machines represent the experience gained in building shapers for more than 60 years.





OHIO offers a wide range of modern machine tools for low cost production. OHIO Dreadnaught Horizontal Boring, Drilling, and Milling Machines—OHIO Production Milling Machines—OHIO Dreadnaught Shapers—OHIO-MURCHEY Threading Machines—OHIO-MURCHEY Roller Cutters—and OHIO Revolving Table units.

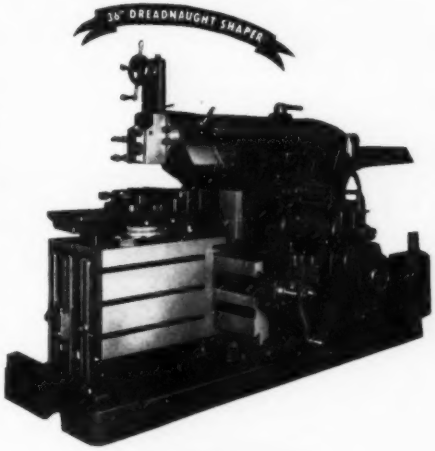
AROUND OHIO MACHINE TOOLS

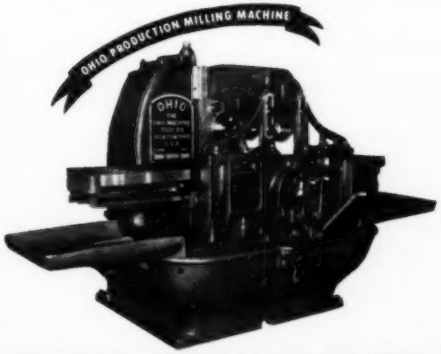
and lower costs

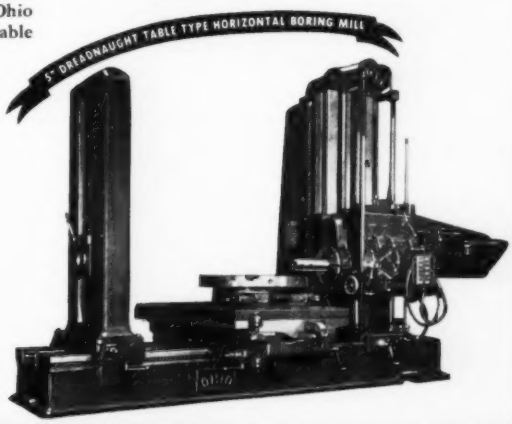
OHIO Dreadnaught Horizontal Boring, Drilling and Milling Machines are pioneers among precision machine tools of this class. Available in both table and floor type models to meet a multiplicity of specifications. They are essential equipment in many of the largest steel mills, shipyards, arsenals and heavy machinery producing plants. Their modern design and ability to meet future demands is the result of constant development—long experience—and scientific study of machinery problems, cutting tools and machine design.

The OHIO PRODUCTION MILLER is designed and built for production work in large or small quantities and has rigidity to take heavy or extremely accurate work. This machine combines all the elements of powerful, true cutter rotation, rigidity, true plane of table travel and positive locked feed essential to modern milling practice.

If you are not familiar with the broad scope of Ohio Machine Tool equipment—their modern development and construction that meets precision production requirements, consult an Ohio representative. Bulletins on all equipment promptly available—write for yours.

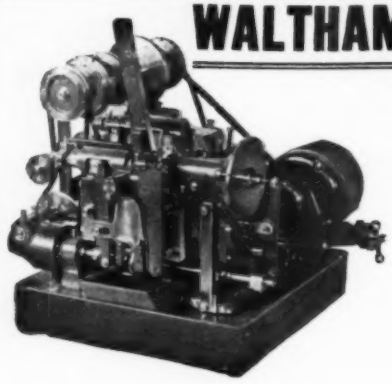






THE OHIO MACHINE TOOL COMPANY KENTON OHIO
SINCE 1887

WALTHAM PINION and GEAR CUTTING MACHINES



Precision and Economy in Mass Production of Small Parts

Specially designed for high speeds and close accuracy, cutting straight teeth in fine pitch pinions, gears for small mechanisms, Waltham Machines are fast, convenient and time-proved on a wide range of work. In all types the same cutting method is employed, by which successive cuts are made by a revolving cutter, blanks being held and indexed by the work spindle. Special cutters furnished to customers' specifications.

TYPES AVAILABLE

Single Cut Pinion Machines—employing one cutter
Multiple Cut Pinion Machines—employing 2 or 3 cutters
Magazine-Fed Pinion Machines—fully automatic
Gear Cutting Machines—single and multiple cut types

Write for illustrated literature giving detailed description and specifications.

WALTHAM MACHINE WORKS
HIGH STREET, WALTHAM, MASS.

WALTHAM TRADE MARK REGISTERED U.S. PAT. OFF.

Speed PRODUCTION WITH . . .
DE-STA-CO *Quality* TOGGLE CLAMPS

Your work-holding tools give fast, uniform clamping action - longer life - greater power — because De-Sta-Co's more than forty models give you *quality* features:

- Well-engineered designs, precision-tooled for uniformity.
- Reamed bearing holes for accurate fit, sensitive operation.
- Foolproof, *positive* toggle action—no cams
- Friction-relieving off-sets in handles, links.
- Cold drawn solid bars—forged portable clamp parts.

New portable and plunger clamps are coming to meet your various work-holding needs. Write for illustrated clamp catalog and name of stocking representative in your area.

DETROIT STAMPING COMPANY
343 MIDLAND AVE. • DETROIT 3, MICH.

Produce your small precision parts with well-known "DERBYSHIRE" accuracy

Illustrated:
The DERBYSHIRE ELECT lathe with 18" bed; ball-bearing headstock with collet closer attachment; double compound rack-and-pinion slide rest with front tool post slide graduated to swivel 360°; six-position turret to take standard tools.

Features and specifications:
Standard ball-bearing headstock, 10,000 RPM; special ball-bearing headstock, 20,000 RPM; chuck capacity .004" to .315"; swing 4.72"; distance between centers: with 15" bed, 5½"; with 18" bed, 8½"; with turret, 6"; standard chuck accuracy, .0002" eccentricity; special chuck accuracy, .0001" eccentricity; turret accuracy, .0005"; maximum turret hole size, 5/8" diameter.

INVESTIGATE TODAY
Write for Catalog

F. W. DERBYSHIRE, INC.
WALTHAM 54, MASS. 157 HIGH STREET

Here's why you get HIGHEST PRECISION and FASTER WORK from TAFT-PEIRCE 6" Rotary Grinders

FAST SET-UPS . . .
Because of the exclusive tilting wheelhead, difficult shoulder and angle work is easily handled. Complicated set-ups are seldom required.

CLOSER TOLERANCES . . .
Full ball-bearing construction, extra-rugged design give truly accurate, vibrationless grinding. Surfaces with finer finishes — flat within exceptionally close limits of tolerance — are easily obtained.

EASY OPERATION . . .
All controls are grouped together for easy, fast operation. Operator fatigue is less, production substantially increased.

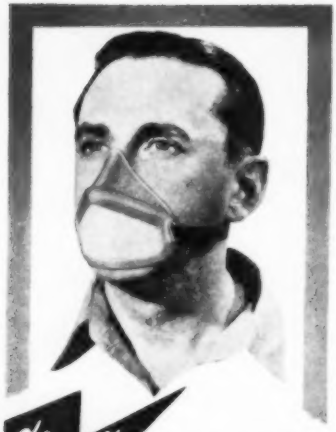
NEGLIGIBLE MAINTENANCE . . .
Hardened and ground ways, full ball-bearing construction, extra-sturdy design result in undiminished precision over an exceptionally long period of time. Users report amazingly low maintenance costs.

REDUCED WHEEL WEAR . . .
Operation is smooth and effortless — free from the vibration which causes uneven wheel wear and short wheel life in the conventional rotary surface grinder.

EASY GRINDING OF DIFFICULT PARTS . . .
The Superpower Magnetic Chuck swivels 7½° to permit accurate grinding of saws, cutters, gear-shaper cutters and similar tools. It easily holds even the smallest work pieces in the center of the face plate.

Write today for bulletin describing this unusual, high-precision rotary grinder.

THE TAFT-PEIRCE MFG. CO.
WOONSOCKET, RHODE ISLAND



New FLEX-A-FOAM FILTER MASK

DUST PROTECTION YOUR WORKERS WELCOME AND *WEAR*

No respirator does any good unless workers will wear it. Even if your men won't use old-fashioned respirators—cumbersome, grotesque, stifling—they're glad to wear the new Flex-a-Foam Filter Mask. Here's why:

- *It's a featherweight—only 1 ounce.*
- *It's snug and comfortable—adjusts to any face size.*
- *It's easier to breathe and talk through than a linen handkerchief.*
- *It's smartly styled—workers don't look or feel peculiar.*

FLEX-A-FOAM'S filter is a honeycomb of whipped foam latex that *keeps out non-toxic nuisance dusts as small as 1/25,000 of an inch!* Frames are of new DuPont Polythene plastic—so flexible they adjust themselves to any facial contours, yet so tough they're unbreakable in normal usage.

For new comfort, new efficiency—new economy, too—order Flex-a-Foam Filter Masks—lowest priced *quality* respirator on the market.

ATTENTION AGENTS AND JOBBERS
Your interest is invited

The Goggle Parts Company — Dept. A.
Cleveland 13, Ohio
Please send full information and prices on Flex-a-Foam Filter Masks.

Name_____
Position_____
Company_____
Address_____
City_____ Zone_____ State_____

THE GOGGLE PARTS COMPANY
CLEVELAND 13, OHIO

"What's so good about H-VW-M cobalt nickel plating processes?"

Richard E. Waite, Field Representative
H-VW-M Rochester Office

When a customer asks that question, he's *really* talking my language. There's no H-VW-M process I'd rather discuss than Cobalt-Nickel, especially the 9-H bath.

"Take plating costs, for instance. 9-H Cobalt-Nickel saves you money because no expensive brighteners, wetting agents, or anti-pitting agents are required. Besides, costly purification shutdowns can be eliminated because the Cobalt-Nickel processes are the only commercial plating baths which can be continuously purified without removing or destroying the active brightening agents.

"And look at your operating range. The composition, pH and operating conditions can be altered to give moderately hard or relatively soft deposits; full brightness or easily-buffed semi-bright deposits. The current density range is limited only by your equipment. And also important . . . Cobalt-Nickel baths can be 100% analyzed and scientifically controlled.

"You say, 'How about results?' Well, for one thing 9-H never produces striated deposits as other nickels do. Instead, the result is always a fine-grained structure containing no organic inclusion . . . better corrosion resistance . . . better even than ordinary buffed nickel. And for even greater fineness of color, additional corrosion resistance and a harder finish, use H-VW-M No. 5 or H-VW-M Type AA Processes.

"And remember . . . H-VW-M works with you all the way . . . shows you how to set up for real low-cost operation with 9-H or any of the other H-VW-M Cobalt-Nickel Plating Processes."

Ask your H-VW-M representative, or write to "Headquarters," for Bulletin G-102, or Cobalt-Nickel Plating Processes.

*Hanson-Van Winkle-Munning has supplied the plating industry for over 70 years. Our sales-engineers are thoroughly familiar with every step in the process of electroplating and polishing. It is this overall knowledge that has made H-VW-M "Headquarters" for electroplating and polishing equipment, supplies and technical assistance.

HANSON-VAN WINKLE-MUNNING COMPANY
MATAWAN, NEW JERSEY
Manufacturers of
a complete line of electroplating and polishing equipment and supplies
Plants: Matawan, New Jersey • Anderson, Indiana
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5862

di-acro PUNCH

NEW DOUBLE PURPOSE PRESS

Available in two sizes, 6" and 12" throat depth

Now you can punch holes of various shapes as large as 4" diameter in 16 gauge steel—also blank, draw, emboss, form—all with the new DI-ACRO Punch. It is ideal for both experimental and production work.

The precision ground triangular ram of this double purpose press prevents punch head from turning, assuring perfect alignment at all times for accuracy in duplicated parts.

A Turret Stripper of exclusive DI-ACRO design automatically strips material from punches of all shapes. Roller Bearing cam action develops 4-ton pressure with minimum effort. Adjustable gauges assure exact location of holes.

Send for "DIE-LESS DUPLICATING" *Catalog*

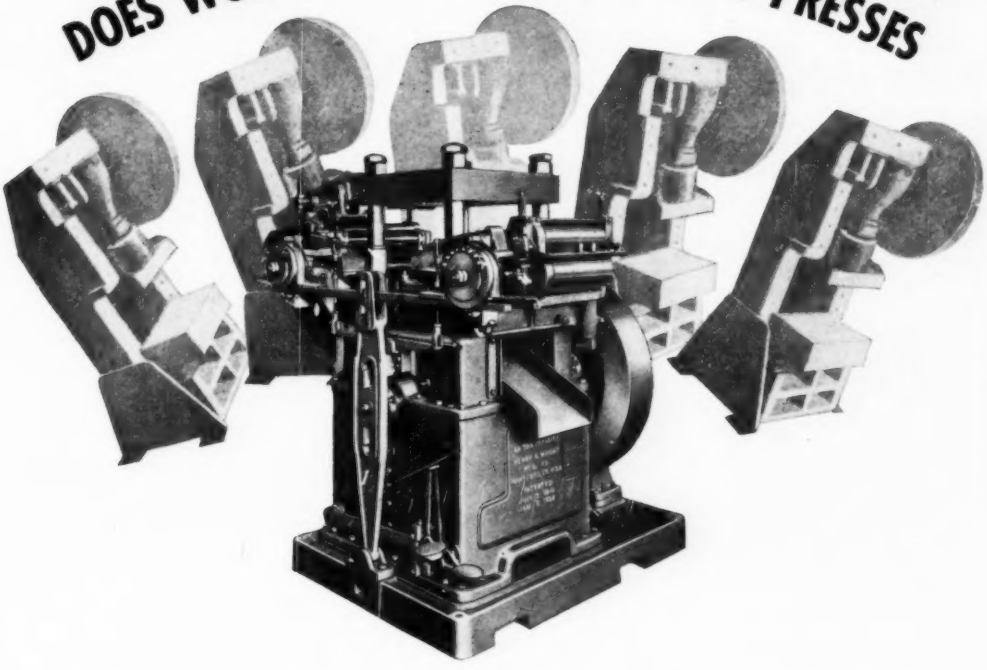
Gives the full story of the DI-ACRO Punch, and also DI-ACRO Benders, Brakes, Shears, Rod Parters, Notchers, as well as the new DI-ACRO Vari-O-Speed Powershear and Hydra-Power Bender.

DI-ACRO is pronounced "DIE-ACK-RO"

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.
311 EIGHTH AVENUE • LAKE CITY, MINN.

ONE HENRY & WRIGHT DIEING MACHINE DOES WORK OF 5 TO 10 ORDINARY PRESSES



Complete-per-stroke production on Henry & Wright Dieing Machines is the modern, cost-saving method of fabricating simple and complex stampings. Instead of a series of interrupted operations, you get the job completed on one machine. One Henry & Wright Dieing Machine customarily does the work of 5 to 10 ordinary presses.

Your die investment is protected, too, because our machines are designed to have the lower crosshead absorb the angular thrust of the crankshaft — it is not transmitted to the punch-carrying member. This improvement increases die life up to 1200% and it means more pieces between grinds. Get complete details on Henry & Wright Dieing Machines. You may save as much as 60% to 90% on your stamping costs. Write for catalog 49. If you wish, we can have a technical representative pay you a visit.

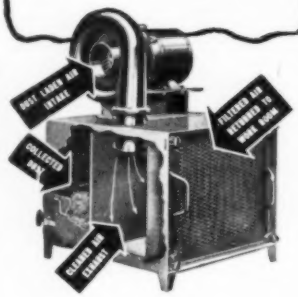
CHECK THESE FEATURES

- Complete-Per-Stroke Production at High Speed
- Die Life Increased up to 1200%
- Low Center of Gravity Minimizes Vibration
- Capacities 10 Tons to 500 Tons
- Pulling Stroke Applied to Die
- Upper Crosshead Takes Only Pressure Required for Work
- Maximum Guiding Surface Insures Perfect and Constant Alignment

HENRY & WRIGHT DIVISION OF HARTFORD-EMPIRE COMPANY HARTFORD 1, CONNECTICUT

ROTO-CLONE
dust control where and when you want it

FOR AS LITTLE AS **$210.00**



THE Roto-Clone Self-Contained Unit is a complete dust control system for individual grinders or small groups of machines. Exhauster, separator and dust storage are all combined into one compact, portable unit. Available in four sizes. Thousands now in service.

MAIL COUPON FOR FREE FOLDER

American Air Filter Company, Inc.
207 Central Ave., Louisville 8, Ky.

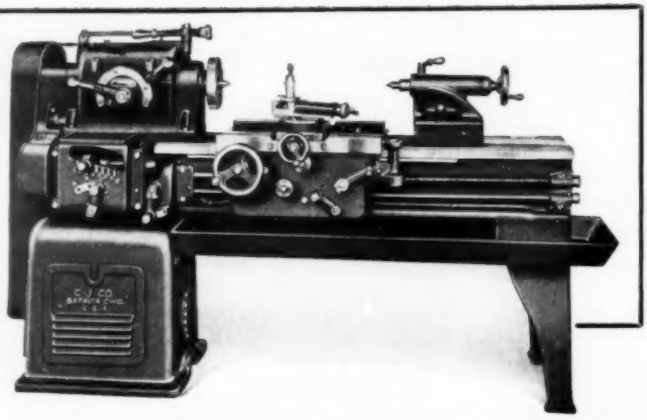
Please send me Roto-Clone Bulletin No. 275-DB.

Name_____

Company_____

Address_____

City_____ State_____



C. & J. Geared Head LATHE 16 INCH 12 SPEED

● Designed for high quality general service. Built in one size and one model only. Powerful, accurate, tooled and equipped to produce efficiently. Features exceptionally long carriage bearing (23⅜"). Feed is provided by separate rod, so lead screw is used only for thread chasing. Complete regular equipment includes thread indicator. Guaranteed accurate within .001 inch in 14 inches. *Write for new descriptive bulletin 38-A-8.*

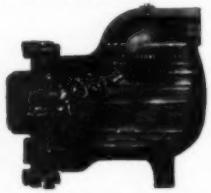
CARROLL & JAMIESON MACHINE TOOL CO.
BATAVIA, OHIO

Send for Nicholson Bulletins on These

4 WAYS TO SAVE TIME
in Production and Maintenance

On the basis of their time-saving records, leading shops are increasingly standardizing on these 4 Nicholson units. For details, send for the individual bulletins listed here.

NICHOLSON EXPANDING MANDRELS—Set of 14 does work of 209 solid arbors; sensational time savers in some operations. Sold singly or in sets; for bores ½" to 7". Bulletin 1043.



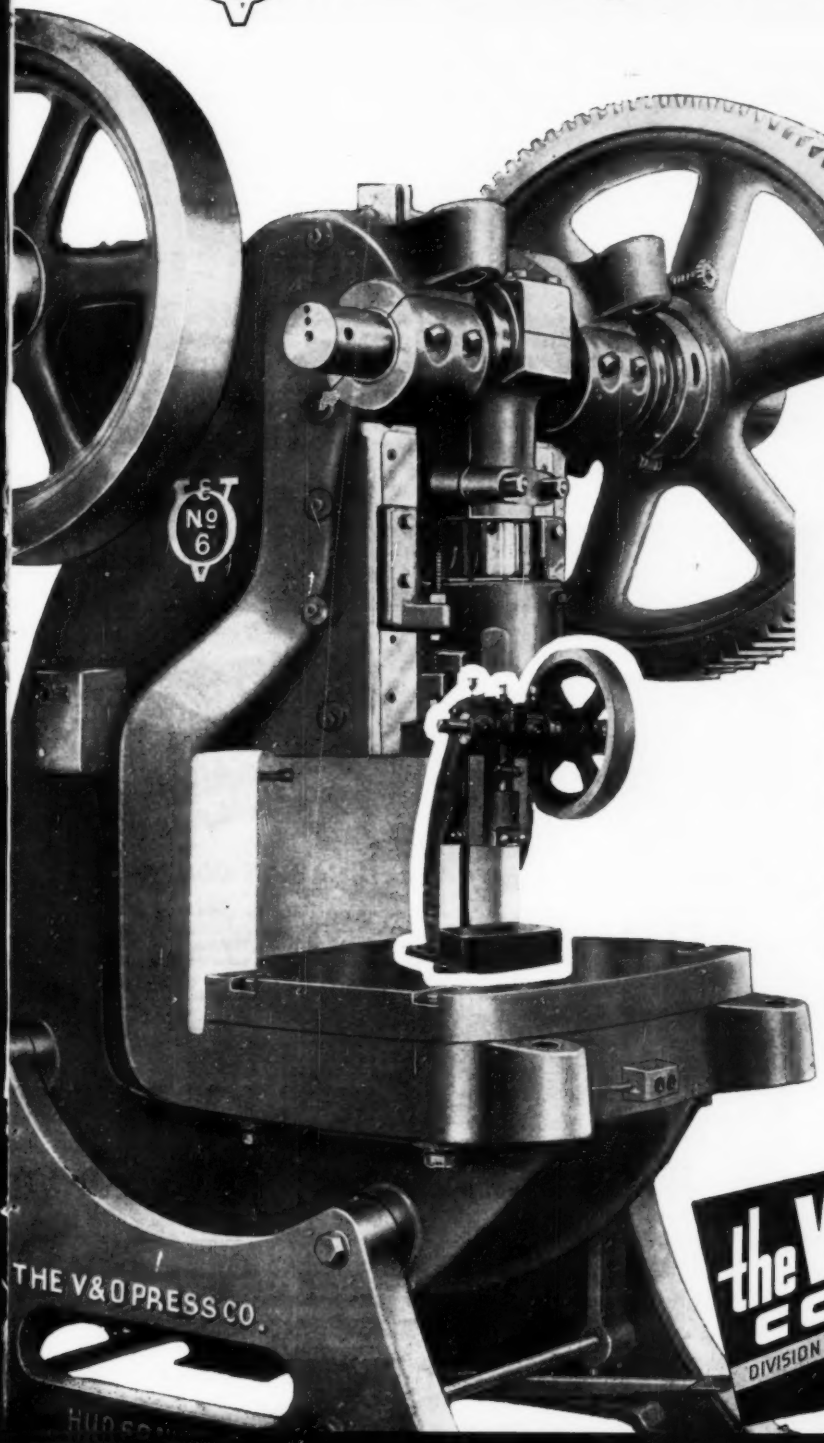
NICHOLSON ARBOR PRESSES—A ready, precision tool for bending, pressing, assembling, broaching, etc. 5 sizes: for 5¾" to 20" diam.; light to 5-ton capacity. Bulletin 845.

NICHOLSON AIR TRAPS—For intercoolers, aftercoolers, receivers, tanks, etc. Non-wire drawing valve opens and closes instantaneously. This feature with extra large drainage capacity effects fast, positive action. 3 types for pressures to 1500 lbs. Catalog 448.

NICHOLSON CYLINDER CONTROL VALVES—Specially treated hard seats, choice of metals for specific mediums, and easy repacking cut maintenance time. 2, 3, 4-way and special types. All manner of operation. Size ¼" to 2½"; pressure to 5000 lbs. Catalog 546.

W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.

V ..to fit your needs..



Wise executives have found out that V&O's precision built POWER PRESSES, ranging from the three-ton minimum to 105-ton maximum with twenty other graduated sizes in between are the answer to profitable, highspeed production. Each and every V&O POWER PRESS, be it one of the STANDARD or T LINE INCLINABLE types, DOUBLE ACTION, STOCKMASTER OR BENCH PRESSES, is a true representative of sound engineering and construction features developed during 60 years of designing and manufacturing POWER PRESSES for a complete cross-section of mass-production industries. Careful workmanship, close inspection and proper selection of materials are combined in the V&O POWER PRESS THAT IS FIT FOR YOUR PRESENT NEEDS.

the V&O PRESS COMPANY

DIVISION OF ROCKWELL MANUFACTURING CO.

HUDSON, N.Y.

ROCKWELL

A Quick, Smooth, Uniform coating — assured by
BARRETT GALVANIZING AND HOT TINNING CENTRIFUGALS

BARRETT CENTRIFUGAL GALVANIZER is driven with high torque head and has an equalized disc brake for quick stop.

With the Barrett Whizo Galvanizer, excess metal is quickly removed from small parts after dipping in molten metal, in fact, much faster and more uniform production is assured. Parts will also pass the most rigid inspection for quality.

The method of handling is simple and easy. Work to be coated is placed in a round basket and submerged in molten metal. When thoroughly heated, the basket is placed in the Barrett Centrifugal to be immediately accelerated to high speed, the excess metal being thrown off before it can cool.

A quick pick up and stop (from 2 to 3 seconds each) assures maximum production with an even thickness of coating.

Machines furnished with or without heated surrounding drum, in capacities from 40 to 240 loads per hour, handling from 5 to 100 lb. loads. When used for tinning threaded work, rethreading has been found to be unnecessary.

Barrett Centrifugals are used extensively, combine speed with convenience of operation and the utmost in safety. They are highly developed to meet all reasonable requirements, have self-contained motor drive and occupy a minimum of floor space.

Send at once for full details of Barrett Centrifugal Galvanizer

THE LEON J. BARRETT COMPANY 1800 Grafton Road, **WORCESTER, MASS.**

Designers and Builders of Centrifugal Machinery

Tap #0 to 3/4" with . . . 1

Commander
TAPPER

The Commander Tapper's exclusive torque control thinks for its operator—automatically stops when taps are dull, overloaded or strike bottom in blind hole tapping.

You get maximum tap protection because the torque control can be set to protect all taps in the range from #0 to 1/4".

Spring clutch drive eliminates slippage and wear — provides smooth, quiet, easy operation.

Commander Tappers are furnished to fit any drill press.

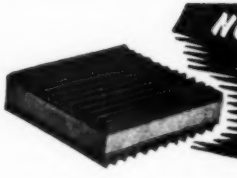
Write for illustrated circular and name of nearest DISTRIBUTOR.

COMMANDER MFG. CO.
4229 W. KINZIE ST.
CHICAGO 24, ILL.

ANY OPERATOR DOES PRECISION TAPPING WITH A COMMANDER TAPPER

•

Product of *Commander* builder of the *Multi-Drill*



NOW AVAILABLE
KORFUND
Elasto-Rib

FOR LOW COST VIBRATION CONTROL

KORFUND ELASTO-RIB — a combination pad utilizing the elastic and damping properties of both rubber and cork—provides a simple, inexpensive method of controlling vibration in all directions, for smoother, quieter operation and longer machinery life. The special construction—cork between layers of deep-grooved, oil-resistant rubber — guarantees a non-skid surface.

It is widely used for isolating machine tools, laboratory and air conditioning equipment, business machines, and also to protect precision instruments from external vibration.

Elasto-Rib is 1" thick, with a loading range of 750-5000 lbs. per square foot. Maximum size of a single sheet is 24" x 36". It can be ordered cut to required size or stocked and cut to size as needed. Write for complete details and free sample.

The Elasto-Rib Damper — a telescoping steel-housed adaptation of Elasto-Rib designed for installations where a machine must be bolted to the floor.

KORFUND VIBRATION CONTROL

THE KORFUND COMPANY, INC.
48-39-B 32nd Pl. • Long Island City 1, N. Y.

The Monthly Robertson Bulletin

HOW TO MAKE YOUR GRINDING WHEELS LAST LONGER

A GRINDING WHEEL wears out in two ways: by working or by being prepared for work.

Do the wheels you are now using demand constant dressing and redressing? Then you are wearing them out just preparing them for work. And no matter what the initial amount, your wheel costs are bound to be high. In addition, you are wasting production time. The solution to this problem is simple: specify Robertson "Cool-Cut" wheels for all your grinding operations, particularly the tough ones.

You don't wear a Robertson wheel out dressing and truing it. Remember, a Robertson is not merely a conventional wheel of extreme hardness. It's a totally *different* wheel. Its unique open structure leaves plenty of space for chip clearance, and the free-cutting qualities last much longer than with a conventional wheel.

Automatic surface grinding of hardened thrust bearings is a good example of the ability of Robertson Wheels to outlast ordinary wheels. A typical job is bearings ranging in size from 2" to 3". Average stock removal per pass is .015", with commercial finish. The longest wheel life the shop could obtain in the past was 60 to 65 hours. Switching to an 18" x 5" x 10" WA808-HV-MC Robertson Wheel, this was increased to an average of 80 hours . . . with no time lost for dressing.

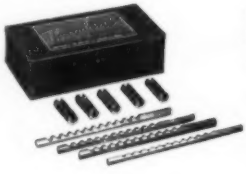
Let a Robertson engineer show you how you can achieve results like this in your own shop. Write on your business letterhead for a free demonstration . . . or "blueprint" your problem and let us recommend a wheel which will solve it.

ROBERTSON MANUFACTURING COMPANY
TRENTON 5, NEW JERSEY

RESIN-BONDED AND VITRIFIED-BONDED GRINDING WHEELS • MOUNTED WHEELS • SEGMENTS

Threadwell Tools do many jobs

try them on your tough ones



When the pinch is on, as it always is, shop aids that cut a corner or reduce a cost are seized upon by harried production men. Threadwell's LITTLE CHAMP Keyway Broaches and Sets fill this bill perfectly.

LITTLE CHAMP Keyway Broach Sets save time because in one compact kit they combine everything needed to cut standard or oversize keyways on a light arbor press.

LITTLE CHAMP Keyway Broaches save time because they cut clean keyways simply and easily in a matter of seconds. Rise per tooth, back-off and rake angle are engineered in proper proportions to accommodate the widest range of materials and applications.

LITTLE CHAMP Keyway Broaches pay their own way because they are ideally suited to handle the jobs that are too small or too infrequent to require an expensive setup. They cut down the man-hours that would be consumed rigging up a make-shift job to handle odd keyway needs.

LITTLE CHAMP Broach Sets complete with shims and bushings come in carbon or high speed steel in a range of models for various applications. Write for Bulletin 434 for complete details on these worrysavers.

Threadwell

THREADWELL TAP & DIE COMPANY, Greenfield, Massachusetts
Taps • Dies • Drills • Counterbores • Keyway Broaches • Screwplates • Gages • Pipe Threaders

ROTO FINISH

IS A

CHALLENGE

TO YOUR

FINISHING COSTS

CHALLENGE is the big word these days on all production jobs, if real economies are to be gained. And nothing can bear more scrutiny than the manual operations in a finishing department. For here you can substitute an efficient mechanical process—Roto-Finish—and make sizable savings!

Roto-Finish methods, materials and equipment put finishing on a production basis, processing huge quantities of parts at costs as low as 75% under tedious hand methods.

Roto-Finish is a versatile operation, adaptable to a host of different shaped parts and many surface requirements. Standard procedures make it easy to gain uniform results, maintain exacting standards, reduce rejects.

The many successful users are the answer that you, too, can profitably employ mechanical Roto-Finishing. Send sample parts for processing, and you'll have the proof! Include finished piece as guide. No obligation.

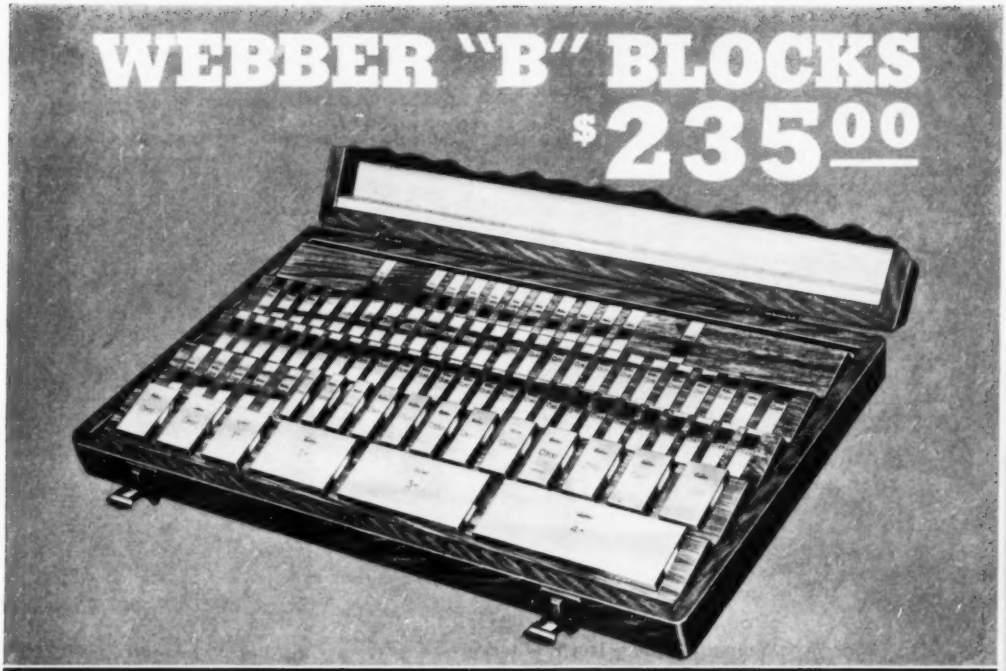
FOREIGN REPRESENTATIVES

Melbourne, Australia — A. Flavell Pty. Ltd.
London, England — Roto-Finish Ltd., 32 Bishopsgate
Windsor, Canada — F. B. Stevens of Canada Limited
Den Haag, Holland — N.V. Roto-Finish Maatschappij voor Benelux

ROTO-FINISH COMPANY
3812 Milham Road, Kalamazoo, Mich.

ROTO-FINISH
ORIGINAL ENGINEERED
MECHANICAL FINISHING PROCESSES

WEBBER "B" BLOCKS $235.00



SAME ORIGINAL PRICE

WEBBER GAGES cover every gage block need

Accuracy: B±.000008"

Standard Steel Blocks

Set No. 84-B (84 block set)	$ 235
Set No. 43-B (43 block set)	150
Set No. 38-B (38 block set)	155

Carblox Carbide Blocks

Set No. 82-B (82 block set)	$1175
Set No. 33-B (33 block set)	495
Set No. 14-B (14 block set)	174

Here is more precision per dollar than you can find in any other block! Other prices have sky-rocketed in the past 10 years. But you still can buy an 84-block set of Webber Gages today at the 1939 price with the same inherent qualities, careful inspection and long wear that have made Webber the nation's largest exclusive manufacturer of precision gage blocks.

Carblox Wear Gages add the wearing qualities of carbide to any standard steel gage block set. Set of 2 with case. Two Sizes.

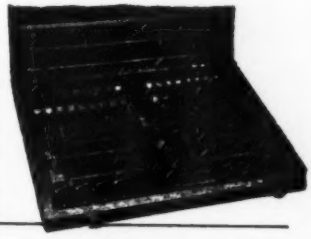
.100	$21.50
.050	27.50

THE WEBBER GAGE COMPANY

12901 Triskett Road Cleveland 11, Ohio

Webber

MICRO-ACCURATE GAGE BLOCKS and FIXTURES



Transferring the extreme precision of gage blocks to the work is one of the outstanding advantages of Webber Heavy Duty (Steel) Gage Blocks and Fixtures. Used as Scriber, Divider, Height Gage and Snap Gage.

SPEED PRODUCTION WITH MIDLAND WELDING NUTS

U. S. PAT. No. 2054189

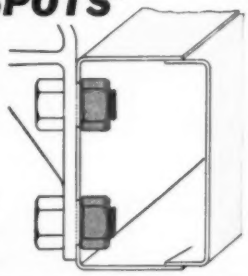
RAPID ASSEMBLY and accuracy are assured by the Midland Welding Nut because it is *self locating*. Collar on nut locates into pierced hole in receiving member. Eliminates use of locating pins or fixtures.

PARTICULARLY USEFUL IN "BLIND SPOTS"

The Midland Welding Nut in concealed and hard-to-reach places, as shown here, speeds up production materially.

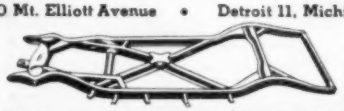
Midland Welding Nuts offer numerous other time-saving and cost-saving advantages.

Write, wire or phone us for complete information.



The MIDLAND STEEL PRODUCTS CO.

6660 Mt. Elliott Avenue • Detroit 11, Michigan



WORLD'S LARGEST MANUFACTURERS OF AUTOMOBILE FRAMES—

LINLEY

SEND SAMPLES
We will gladly rivet sample parts and return them for your inspection.

LLN 49

WHERE RIVETING "KNOW-HOW" COUNTS

The practical knowledge that has solved many an "impossible" riveting problem is built right into Linley Riveting Machines. Designed to maintain accuracy and quality of work under hardest conditions. Rotary spinning principle shapes heads noiselessly . . . capacities to 5/8" diameter. Adjustable spindle stroke, controlled pressure . . . thrust bearing supports spindle, carries load. Eight models. Bring our experience into your plant and make your tough jobs easy.

LINLEY BROTHERS CO.

674 STATE ST., EXTENSION
BRIDGEPORT 1, CONNECTICUT

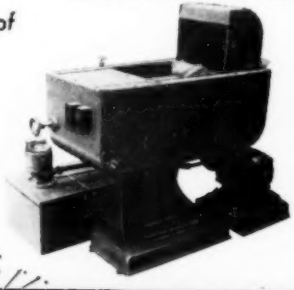
Announcing **a new size PEERLESS WET BELT SURFACER No. 1W 9"**

. . . for the fast, economical surfacing of a wide variety of parts

Available in 9"-14"-20" Sizes

Send us samples of your work for full laboratory report—No obligation.

By popular demand we have added this 9" size wet surfacer for those not requiring the larger belt widths. It is adaptable to flat surfacing a wide variety of materials such as die casting, plastics, metals, fibre, rubber, etc. A smooth accurate surface can be obtained often replacing an expensive machine tool operation.

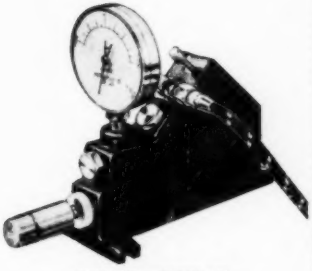


Production MACHINE COMPANY GREENFIELD MASSACHUSETTS, U.S.A.

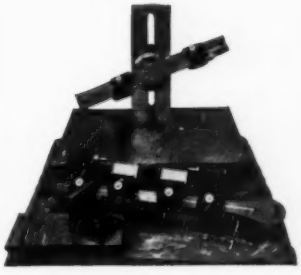
Look to Merz

for precision equipment for every inspection need!

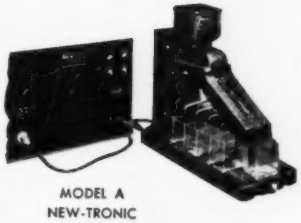
EXACTITUDE
STANDARD A.G.D. GAGES



VERSATILE—MODEL 30
NEW-MATIC MEASURING MACHINE

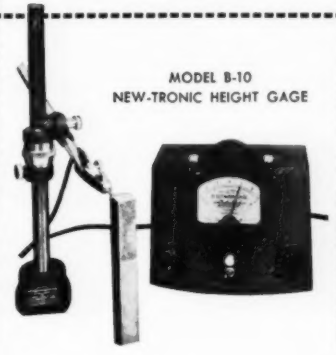


MASTER MODEL
UNIVERSAL CHECKING PLATE



MODEL A
NEW-TRONIC
BALL SORTER

MODEL A-10
NEW-TRONIC
COMPARATOR



MODEL B-10
NEW-TRONIC HEIGHT GAGE

VIGILANT—MODEL 60
NEW-MATIC
MEASURING MACHINE

Whatever your inspection requirements, look with complete confidence to Merz precision measuring and checking machines. Every Merz product is a proved cost-cutter, a tested time-saver. The Merz line includes *New-Matic* Measuring Machines, *New-Tronic* Comparators and Gages, Checking Plates, Standard A.G.D. Gages. Merz also specializes in the custom-building of equipment for handling unusual inspection and sorting problems, however complex. Merz inspection equipment has for years been helping to reduce loss, speed production and increase profits for many of the nation's leading industries. Write for complete information on how Merz' "Four Spheres of Service" can do the same for you.

MERZ ENGINEERING COMPANY • INDIANAPOLIS 7, INDIANA

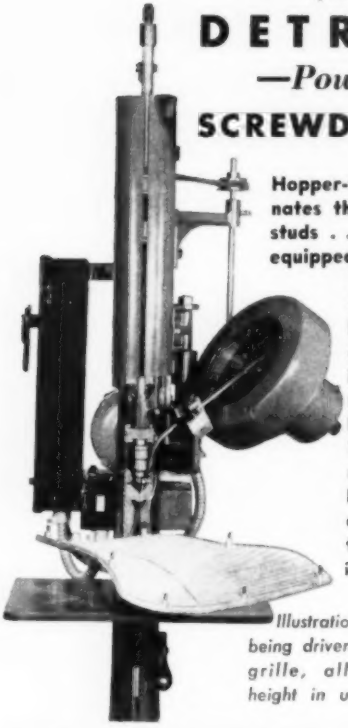
MERZ

The House That Precision Built

A MODERN WAY OF DRIVING STUDS

by using

DETROIT *—Power—* SCREWDRIVERS



Hopper-feeding eliminates the handling of studs . . . Machine is equipped with Titan or Modern studsetters... Machine will drive up to ¼ inch diameter studs in lengths up to 1¼ inches in untapped holes in die castings or tapped holes in steel.

Illustration shows studs being driven in automobile grille, all to uniform height in untapped holes.

Motorized HOPPER UNITS

USED WITH:

Presses, Centerless Grinders, Thread Rolling and Slotting Machines, or Special Machine.

FEED:

Screws, Screw Blanks, Rivets, Pins, Discs, Nuts, Bearing Rollers, Steel Balls, Washers. Also miscellaneous items, such as screw-machine parts, stampings, etc. etc.

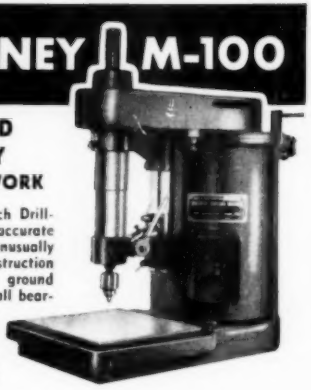
MADE IN 6 DIAMETERS:
8", 10", 12", 16", 24", 30"

Send Samples for Details and Prices

DETROIT POWER SCREWDRIVER CO.

2797 W. Fort Street — DETROIT 16, MICH.

SIGOURNEY M-100



MAINTAINED ACCURACY IN PRECISION WORK

The Sigourney M-100 Bench Drilling Machine is extremely accurate on precision jobs. It is unusually sturdy and rigid in construction . . . has hardened and ground spindles . . . and sealed ball bearings throughout. All moving parts are entirely closed for maximum operator safety. M-100 is built for long and steady service.

This sturdily constructed bench drilling machine is available in 1, 2, 3, and 4 spindle models . . . speeds from 4,000 to 10,000 r.p.m.

Send for illustrated bulletin

THE SIGOURNEY TOOL CO.
Hartford 6, Conn.

Sole Sales Agents

PRATT & WHITNEY
Division Niles-Bement-Pond Co. . . . West Hartford, Connecticut

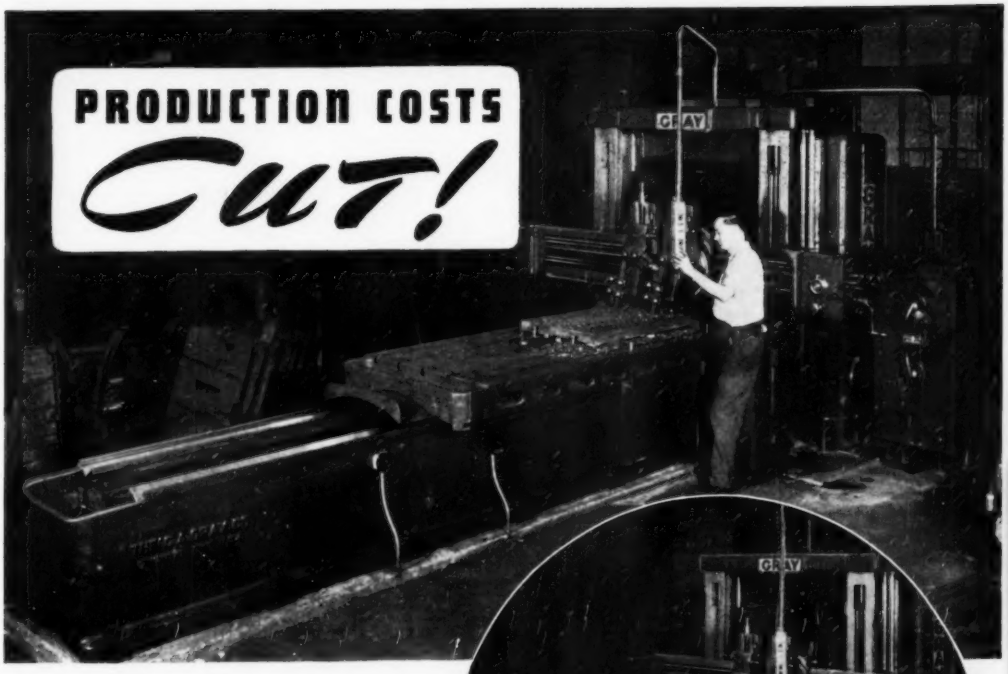
Improper tightening of screws, nuts, and threaded parts, accounts for many of the "bugs" that develop in mechanisms . . . causes binding, breakage, chatter, thread stripping, leakage, squeaks and loosening and loss of parts.

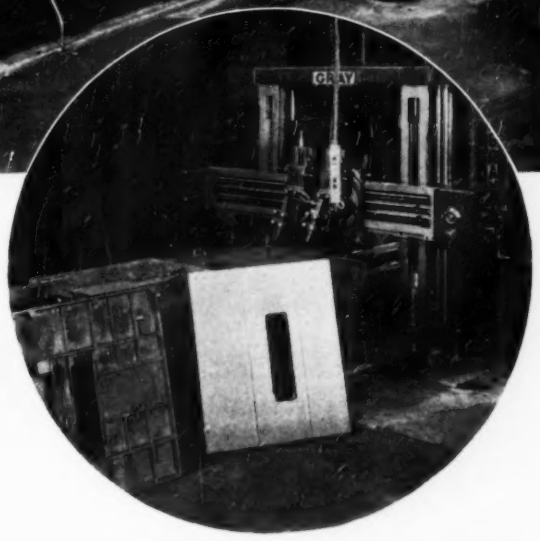
These mechanical faults can be eliminated with a resultant improvement in product quality by torquing all critical points with STURTEVANT TORQUE Wrenches. Inherently and permanently accurate, STURTEVANT TORQUE WRENCHES are as easy to use as an ordinary socket wrench, and are extremely fast on the production line.

Write for Bulletin SW5

P A STURTEVANT CO.
ADDISON QUALITY ILLINOIS

PRODUCTION COSTS *Cut!*





The Oliver Machinery Co., of Grand Rapids, Mich., has greatly reduced the time required to plane their wood working machinery with this new GRAY PLANER.

Here are some typical savings:

	OLD TIME INC. SET UP	NEW TIME INC. SET UP	% INCREASED PRODUCTION
Rough Plane Small Wood Planer Table	2.9 hrs.	1.8 hrs.	61.0%
Rough & Finish Plane Large Lathe Bed	54.0 "	25.75 "	110.0%
Rough Plane Large Wood Planer Table	7.4 "	5.9 "	25.5%
Finish Plane Wood Planer Table	4.5 "	1.58 "	185.0%
Rough & Finish Plane Small Lathe Bed	24.3 "	13.9 "	75.0%

And in addition, finish accuracy has been greatly improved!

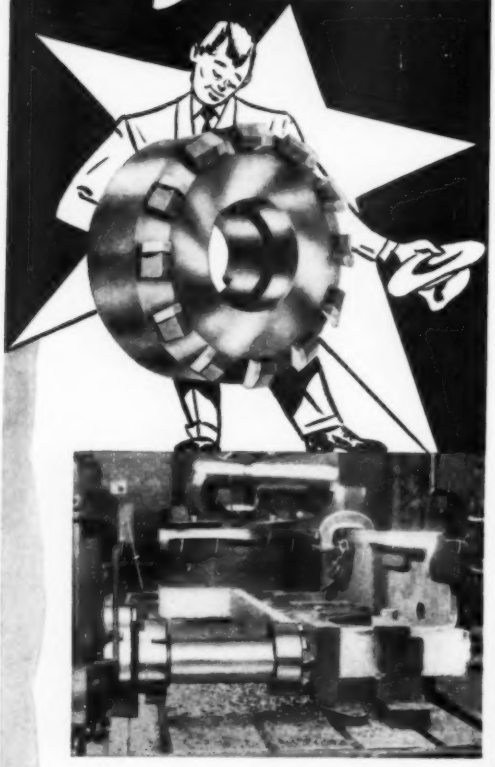
FOR FASTER, BETTER PLANING—INVESTIGATE THE NEW GRAY

The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

MEET OUR *Star* SALESMAN



Perhaps you have already heard how much you can save by using Howald SQUARE BLADE Carbide Milling Cutters. Now, we introduce our "Star Salesman" who can convince you about their superior performance.

This "Smooth Cut" 6" Carbide Shell Mill, with its unique combination of cutting angles, went into a plant which was having trouble milling high strength cast iron. The best they could do was a maximum feed of 5 IPM at a spindle speed of 190 RPM — production was slow and there was distracting chatter. Then this Howald S6-10 went to work —spindle speed was reduced to 80 RPM — the feed rate was increased to 14 IPM — chatter was eliminated — and, production rate and cutter life were doubled.

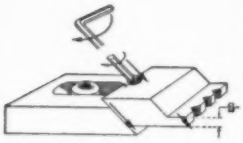
Learn how Howald's "Star Salesman" can help you. Write for our Bulletin 23C.

W. T. HOWALD MACHINE WORKS
182 Sigourney Street Brooklyn 31, N. Y.

SAVE TIME AND MONEY

with these new side-gripping Self Locking

Jaw Clamps



J & S Jaw Clamps hold all sizes and shapes of work-pieces tightly against face plates of machine tools. Clamp is self-locking and full surface of work 3/8" high or over may be machined without interference, because the jaws grip the work-piece on the sides. These Clamps facilitate controlled centering adjustment—secondary operations are unnecessary—they eliminate different length studs and blockings—tested for two-ton down pressure. Send for details.

J&S TOOL CO., INC.
479 Main Street, East Orange, N. J.
Representatives in Principal Cities

WHY?
shop around for
Cap Screws • Set Screws
Milled Studs • Coupling Bolts
when you know
WHO*
has been making the finest for over half a century

*WHO is...
WM. H. OTTEMILLER CO.
YORK, PENNA.
Send for Free Literature.

RANDALL & STICKNEY
Universal Gauge

for rigid inspection of a wide range of parts . . .

An almost unlimited use is offered by this instrument for inspecting duplicate parts in quantity or any small parts with flat surfaces or recesses.

Use of standard blocks made possible by raising or lowering table increases capacity to take material up to 2" in height. Graduated to read to .001 inch; height 9¾"; weight 5 lbs. 1¼ oz.; depth from frame to spindle 1⅝".

Full details on request

Can be supplied with sliding head and table; also on a stand with throat 3" deep.

FRANK E. RANDALL CO., INC.
248 Ash Street
Makers *Waltham 54, Mass.*

THE TIMKEN-DETROIT AXLE COMPANY LOOKED THROUGH THESE GLASSES

NOW, ONE NEW LEES-BRADNER ROTARY and ONE OPERATOR

has replaced

Several operators running a number of single spindle machines

Hobbing splines on axle shafts

1 - Only one man operating one 8-spindle machine in place of two men operating 8 single spindle machines, plus increased net output of 20%.

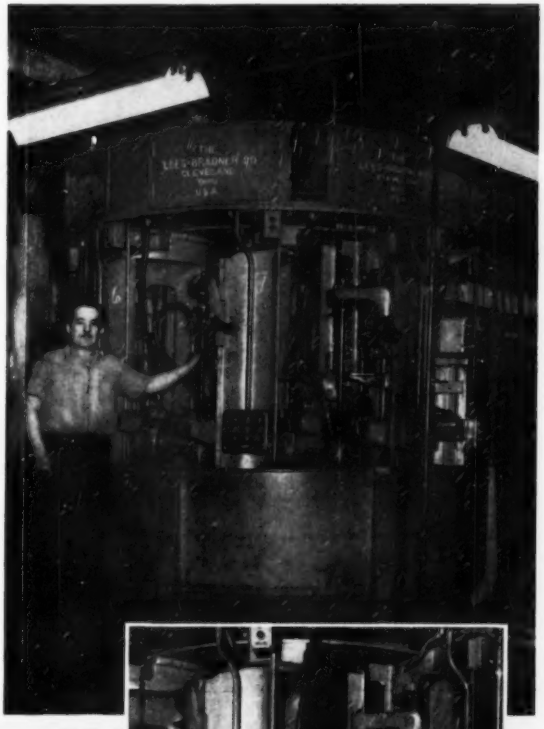
2 - Constant flow of production from conveyor to conveyor . . . no piling up ahead of machine.

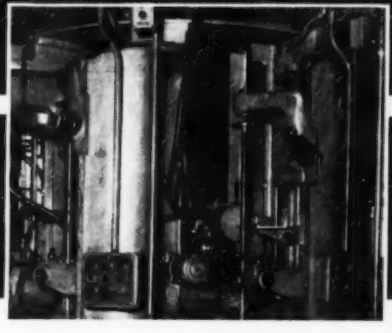
3 - Lees-Bradner rotary/flexibility handles 18 different shafts varying in spline diameters as much as an inch . . . in overall shaft length as much as 2 inches . . . various number of teeth, too.

4 - The rotary often handles four different shafts simultaneously.

5 - Lees-Bradner accuracy and rigidity has improved the already high quality of the Timken Detroit Axle.

WRITE TODAY FOR BULLETIN NO. 59-A

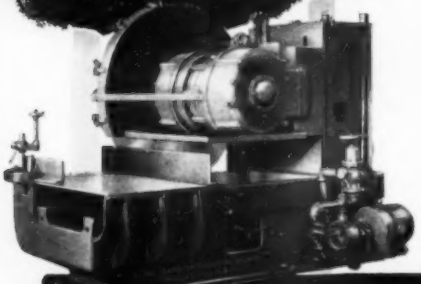




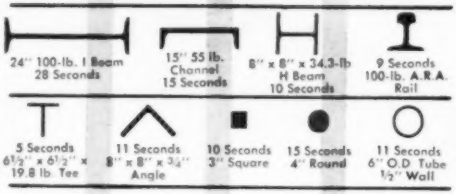
The **LEES-BRADNER** *Company*

CLEVELAND 11 OHIO U S A

Modern Sawing



with KLING HIGH SPEED FRICTION SAWS



Friction sawing is one of few mechanical processes which employ the heat of friction in a useful manner. It concentrates heat on the material to be severed at a rate which is faster than it can absorb heat. The immediate temperature rise of the contact surface is so great that its strength is reduced considerably lower than that of the colder blade rim. This heated surface is readily removed by the blade and permits complete severing of the material rapidly with no loss of metal from the blade.

Because of its versatile ability to cut many varied structural shapes, as well as solid or hollow bars in any sequence, without change of blade or set-up, one machine can handle a volume of cutting that would otherwise require several separate shears or slow speed saws.

Consult Kling engineers regarding your metal cutting problems. State size of material to be cut. Bulletin No. 9200 giving full particulars and suggestions as to the type and size of saw will be mailed promptly. No obligation.

KLING BROS. *Engineering Works*

Punches; Bar, Angle and Rotary Shears; Combination Shear, Punch and Copers; Plate and Angle Bending Rolls; Heavy Duty Grinders

1328-AM N. KOSTNER AVENUE, CHICAGO 51, ILLINOIS, U. S. A.

Severance CUTTING TOOLS

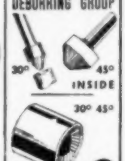
HIGH SPEED CARBIDE

MIDGET MILLS - ¼" Shanks
GROUND-from-the-Solid

MORE THAN 20 SHAPES--EACH IN SEVERAL SIZES

Obtain the best from the originator of GROUND-from-the-Solid

DEBURRING GROUP



Severance JUNIOR MILLS-⅛"Shanks
GROUND-from-the-Solid

Practical for use on small grinders, for finishing Patterns, Dies, Parts, etc., in places difficult to reach with the larger Mills.

HIGH SPEED and CARBIDE

TUBING GROUP

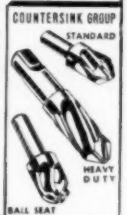
Truly REVOLUTIONARY Cutting Tools

Severance LAB MILLS—⅛" Shanks

These speedy Mills for Dental Laboratories find many uses in Jewelry and in Die and Mold making. Available in 10 popular shapes in 4 or more sizes each, for the finest cutting and finishing. May be resharpened up to 8 times per ⅛" reduction in diameter

Write for Catalog No. 16

COUNTERSINK GROUP



Complete REGRINDING Service — by New Tool Craftsmen — Savings are thus multiplied —

SEVERANCE TOOL INDUSTRIES, INC.
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BUZZER Gas BURNERS

NO BLOWER OR OTHER POWER NEEDED!

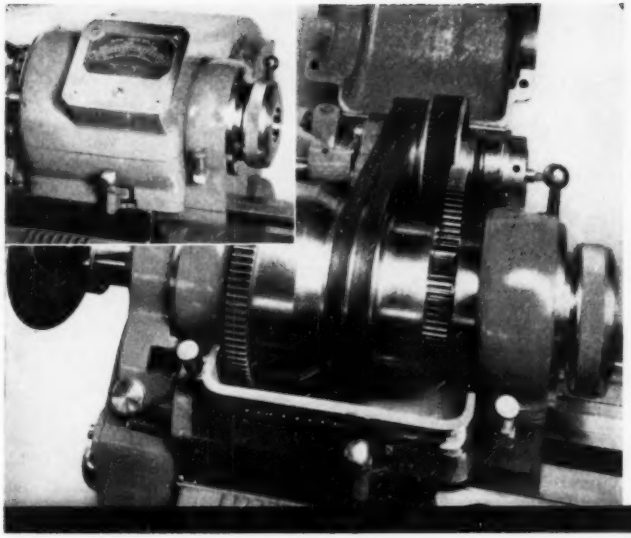
. . . JUST CONNECT TO GAS SUPPLY.

Designed to solve innumerable Heat applications. Unexcelled for efficiency, economy, simplicity, and flexibility.

The Complete "BUZZER" catalog shows Gas Burners, Furnaces, and other equipment. Write for your copy today.

CHARLES A. HONES, INC.

121 So. Grand Ave. Baldwin, L. I., N. Y.



Wade NO. 8A VARIABLE SPEED DRIVE with ELECTRIC TACHOMETER

Speeds from 32 to 2000 R.P.M.

This is the only lathe of this size and type, offering such a range of *stepless* spindle speeds!

(With the back gears engaged, the stepless spindle speeds are from 32 to 220 R.P.M.)

An *exclusive* feature of the Wade No. 8A TOOLMAKER'S PRECISION LATHE

THIS DRIVE IS FOOLPROOF! It is entirely mechanical . . . cannot be damaged by changing spindle speeds either while the lathe is running or stopped. Reason for this is the unique clutch arrangement that makes it possible to *start, stop,* and *brake* the spindle with the motor running! This is a distinct advantage over most lathes, which rely on the motor and a brake to start and stop the spindle. **Write today for circular describing the Wade No. 8A**

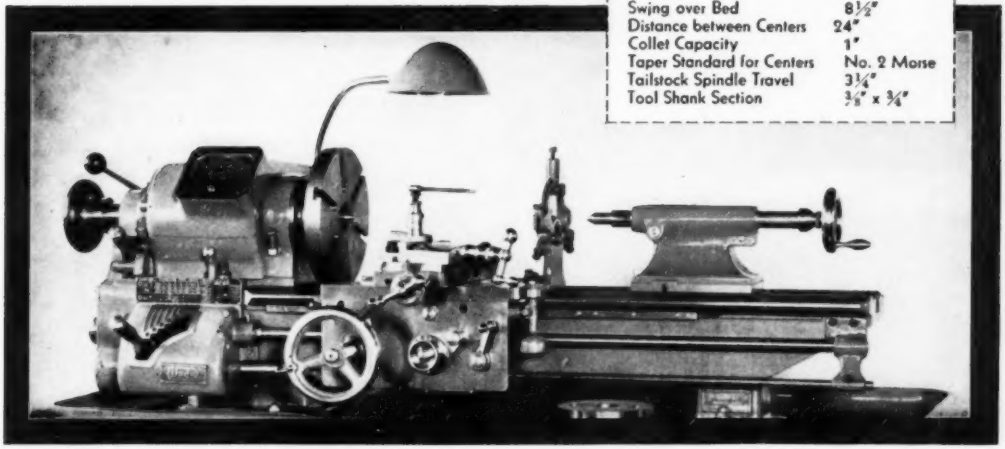
AMPLE TORQUE for low speeds. Powered by a 1 HP motor, with electrical controls in an enclosed panel protecting it for either high or low voltage. Back gears of 9-to-1 ratio assure ample torque at low spindle speeds.

MATCHED V-BELTS for high speeds. For high spindle speeds, matched V-belts are used on an open drive. Belt adjustment is easily maintained, as the countershaft is on an eccentric and a slight turn in either direction keeps the belt in proper tension.

THE WADE TOOL CO. 53 River St., Waltham 54, Mass.

SPECIFICATIONS

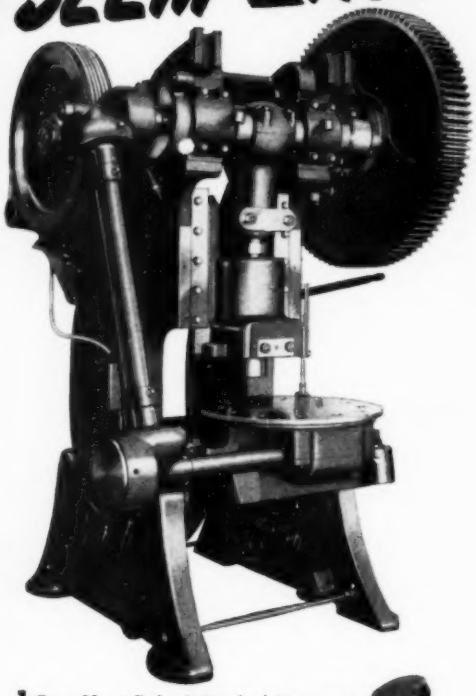
Swing over Bed	8½"
Distance between Centers	24"
Collet Capacity	1"
Taper Standard for Centers	No. 2 Morse
Tailstock Spindle Travel	3¼"
Tool Shank Section	⅝" x ¾"



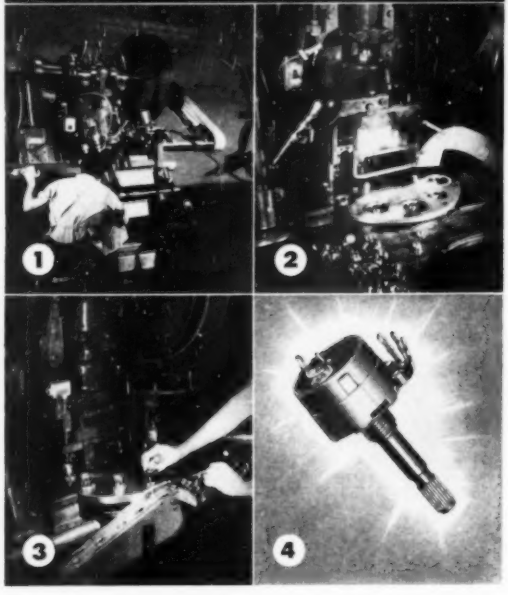
This Dial Feed Press makes

TOUGH JOBS SEEM EASY

Production engineers have learned that Federal Dial Feeds can handle a wide variety of difficult press operations... do a better job faster, easier and with much greater safety. Federals are extremely versatile, performing with equal efficiency whether the task be to punch, crimp, burr, broach, draw, stamp, pierce, or assemble. With a Federal Dial Feed you can increase hourly output, operate with minimum down time and make tough operations seem simple. Federals may solve a specific problem for you. Eight sizes from 6.6 to 79-tons.



HERE'S A TYPICAL FEDERAL DIAL FEED INSTALLATION:



1 On a No. 5 Federal Standard Press at a radio parts manufacturing plant, covers for a radio component are drawn from automatically-fed coiled steel.

2 Piercing is accomplished at high speed on a 12-station Federal Dial Feed. Blank covers are fed by hand and automatically ejected.

3 On a No. 3 Federal Dial Feed, laminated bakelite base is inserted by hand into a similar cover; each part is crimped in three places, then ejected by compressed air.

4 Completed part for use in radio and television sets. By using Federals, this manufacturer accomplishes varied operations safely, efficiently, with greater speed.

WRITE TODAY FOR THE NEW DIAL FEED CATALOG

THE FEDERAL PRESS COMPANY
491 DIVISION ST., ELKHART, INDIANA, PHONE 2831

FEDERAL *Dial Feed* **PRESSES**
BUILT FOR SERVICE

MRC
MRC
the M-R-C "Synthe-Seal" bearing
A standard-dimension ball bearing with a remov-
able synthetic rubber seal for keeping out dirt, grit
and moisture and for keeping in lubricant.
MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y.

CONTROLLED ACCURACY...

LOBDELL NAZEL FORGING HAMMERS

. . . the force of the blow can be instantly and accurately controlled for all types of forging, without varying the ram's constant stroke frequency. There are 7 definite advantages in Lobdell Nazel Forging Hammers:

1. Self-contained. Air-actuated. Motor-driven. Require no compressor, accumulator or piping.
2. Consume power only while operating.
3. Provide a powerful, squeezing blow.
4. Positive in action.
5. Simply controlled.
6. Heavy, rigid, durable construction assures long, trouble-free life.
7. Efficient. Fewer reheats, less labor, lower costs.

Write for your copy of the Hammer Book which describes in detail, operating principles and construction features.

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AN ASSOCIATE COMPANY OF AMERICAN CHAIN & CABLE COMPANY, INC.

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Willey's — The COMPLETE LINE of cutting tools — made complete in our own factories. Hundreds of standard sizes in stock. Prompt service on special tools built to your specifications.

We are now filling orders calling for the new industry standard tool numbers and sizes.

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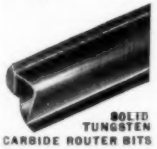
TIPPED TWIST DRILLS



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WILLEY'S CARBIDE TOOL CO.
SOLE MAKERS OF WILLEY'S METAL
1342 W. Vernor Highway Detroit 1, Michigan

"V-Belt Inventory?

. . . it's no problem since we standardized on VEELOS!"

4 REELS OF VEELOS *replace* 316 SIZES OF ENDLESS V-BELTS

Write for your VEELOS Data Book . . . it's free and it's full of engineering, measuring and installation information on Veelos. Everyone interested in power transmission should have a copy for ready reference.

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

"I DON'T like to tie-up operating capital . . . who does? That's why; in our plant, we use Veelos on all v-belt drives. In the old days our stockroom was a dangling mess of endless v-belts. But no more. Now, on wall space only sixteen inches square, hang 4 reels of Veelos. Those 4 reels in O, A, B and C widths take care of *all* our v-belt needs. Simple story sure, but a sound, practical picture of saving money the Veelos way."

And there are other advantages beyond the saving of inventory when you standardize on Veelos, the adjustable v-belt. Veelos is easy to install—just measure and couple. You never dismantle outboard bearings to replace Veelos v-belts—that keeps machine downtime at rock bottom. Uniform operating tension, smooth, vibrationless power delivery and long life are more plus values from Veelos.

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

VEELOS
THE LINK
V-BELT

Veelos is made in all standard sizes; fits all standard v-belt grooves. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

The

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ONE TWO THREE

7 spindle tool rotating automatic chucking machine

Four Machine Spindles for boring, turning, facing and reaming operations on one to three ends provide greater and quicker production than any other "chucker" in the machine tool industry

Three Threading Spindles perform from one to three right or left hand single or double threading operations, on one, two or three ends simultaneously, in perfect alignment, at productions from 100 to 500 pieces per hour.

Write for further interesting details.

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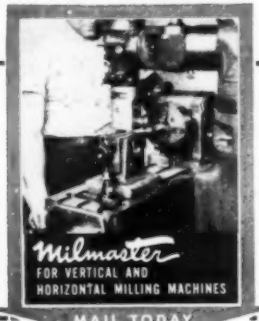
MACHINE COMPANY
KENSINGTON, CONNECTICUT, U.S.A.

YOUR MILLING MACHINE CAPACITY

DOUBLED!



Convert your milling machine... horizontal or vertical... into a universal miller and *double* your capacity. Reduce set-up time by as much as two-thirds.

Built by one of New England's oldest metal working specialists, the MILMASTER is a sturdy tool of proven value. Wherever it is used it has paid for itself in a matter of hours.

Get the facts!

MAIL TODAY

BEMIS & CALL COMPANY, 300 Main St., Springfield, Mass.

Please send me the bulletin giving the full details on the Milmaster.

Name_____

Company_____

Address_____

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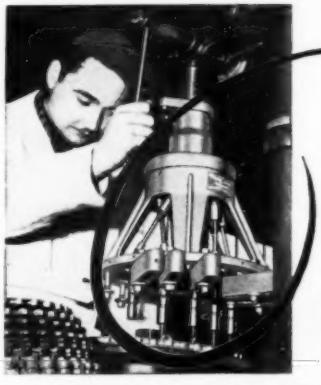

MULTIPLE DRILLING *with a* **MULTI-DRILL**

INCREASES CAPACITY UP TO 800%

ADJUSTABLE TO ANY HOLE PATTERN . . . FITS ANY DRILL PRESS

If your production requires drilling from 2 to 8 holes in a work piece, a MULTI-DRILL will cut costs and speed output up to 800%. The MULTI-DRILL is universally adjustable to any hole pattern—is compactly built to permit easy, unhampered operation with drill jigs or other special fixtures. Ruggedly built to take the wear and tear of high production work, the MULTI-DRILL will handle your long and short run multiple drilling jobs with ease and economy. The MULTI-DRILL will drill on hole centers as close as ½"—handle drill sizes up to ⅜" in steel. Special adaptations available.

There is a Commander MULTI-DRILL Distributor in your area. Write for his name, literature and complete details.

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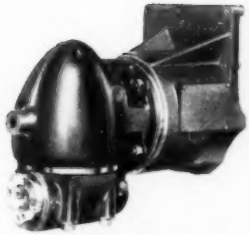
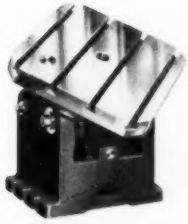
Product of *Commander* — Builder of the *Commander Tapper*

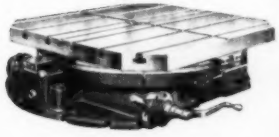
"repeat-business" quality runs in the family



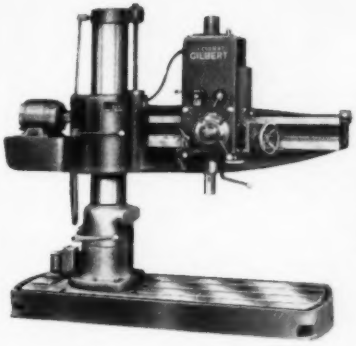
Full Universal Milling Attachment, Rugged Versatile. Swivel and spindle carrier revolve 360°. Spindle nose has No. 50 National Standard Taper.



Universal Table. Five sides of a cube can be machined at one setting of work piece. Sizes: 22" x 22" and 27" x 27" top. For use on Radial Drills and Horizontal Boring Mills.



Rotary Table. Positive accurate indexing device. Worm feed or hand revolving. Square tables 24" x 24" to 50" x 50". Round tables 24" OD to 50" OD.

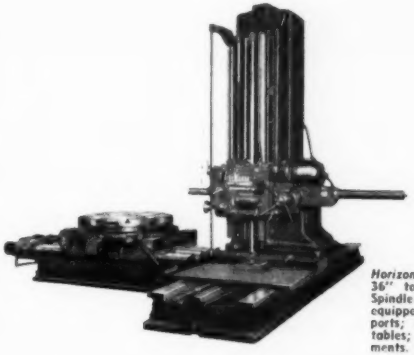


Radial Drilling Machines, 9" and 11" columns. Centralized controls. Maximum visibility of work. 12 speeds, 6 feeds. Twelve basic features that make these machines the most modern radials you can buy. Radials with 13" to 19" columns, with arms up to 8' also furnished. Write for bulletin 349.

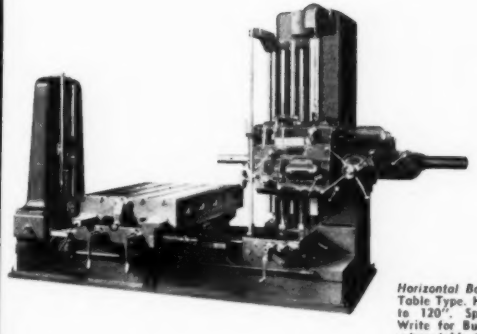
THE CINCINNATI

GILBERT MACHINE TOOL COMPANY

RADIALS • HORIZONTAL BORING MILLS • ACCESSORIES



Horizontal Boring Mill. Floor type. Head travel: 36" to 96". Column travel: 36" to 180". Spindle diameters: 3½" or 3¾". Can be equipped with floor plates; boring bar supports; stationary, sliding, or built-in rotary tables; revolving columns, and special arrangements. Write for Bulletin 1244.



Horizontal Boring Mill, Compound Rectangular Table Type. Head travel: 36" to 72". Bed: 84" to 120". Spindle diameter: 3½" or 3¾". Write for Bulletin 1040-R. Compound built-in rotary table types also furnished in comparable sizes. Bulletin 348. . . Write to the Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio

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precision made for precision numbering

Produced from special steel . . . manufactured by master craftsmen, Noblewest automatic numbering heads are the finest made. All parts are precision made to stamp your products clearly and permanently. Name plates, model and serial numbers for machines, key numbering for component parts . . . whatever the numbering or marking job . . . Noblewest automatic numbering heads will answer your requirements.

Standard models available in sizes from 1/40" to 1/2". *Special models* combined with dies — also embossing or debossing heads. In addition to numbering on steel, they can be used on other metals, wood, fibre, hard rubber, plastics, etc. Let Noblewest answer your numbering problems.

Write Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

How to Use More Color in the Shop for

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Here is a wealth of practical information on the use of Functional Painting. This Special Report's 16 pages . . . illustrated in full color . . . provide you with valuable data on planned color in the shop as an aid to better production.

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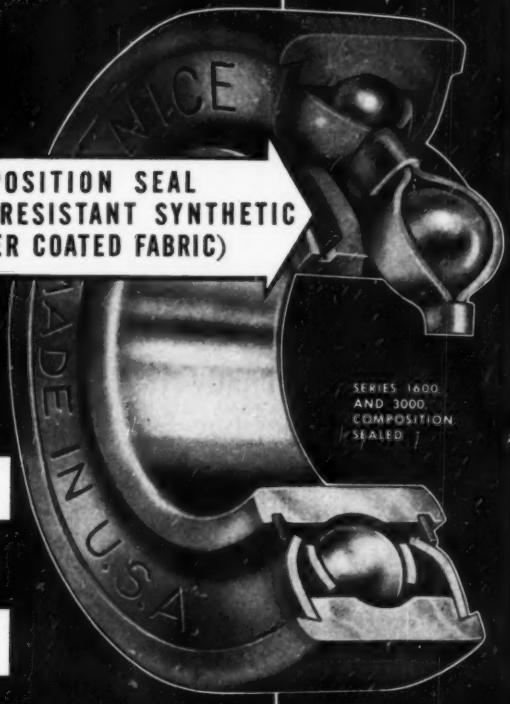
American Machinist

McGRAW-HILL BUILDING
NEW YORK 18, N. Y.

Announcing!

Composition Sealed Bearings by NICE



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Exhaustively field tested and proven highly successful, the NICE composition seal design effectively retains lubricant and excludes foreign material. Thus, NICE has added the performance advantage of an efficient seal to the already basic advantage of a quality bearing at comparative low cost.

Write for New Catalog No. 140

NICE

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

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The Atomic Age and new Aircraft Designs needed chucks for holding non-ferrous metals.

Naturally, these new developments turned to Walker. The result:

"Walker Does It Again" with the Walker Vacuum Chuck.

Whatever your holding problem, Walker technicians, backed by sixty years of experience and leadership, will solve it for you.

Hold Everything! with Walker Chucks

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Original Designers and Builders of Magnetic Chucks

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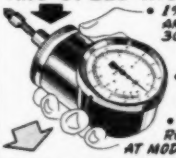

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Ideal for Motors, Shafts, Spindles, Looms, Turbines for Textile and Power Plants.

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STOCK SHAPES

For All Makes of Power, Hand and Foot Presses

Carried in New York stock for immediate shipment

Metal-working Punch and Die Specialists for sixty years.

Send for circulars covering our line.

T. H. LEWTHWAITE MACHINE CO., INC.

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KRW ANNOUNCES

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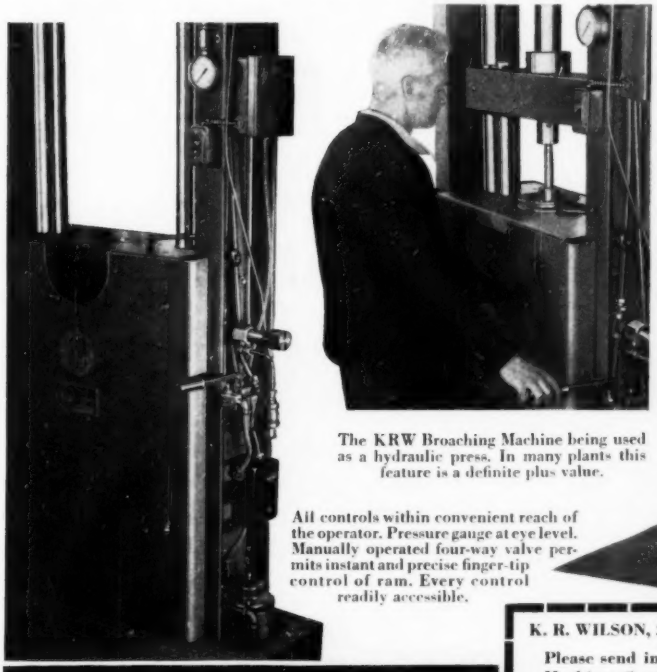
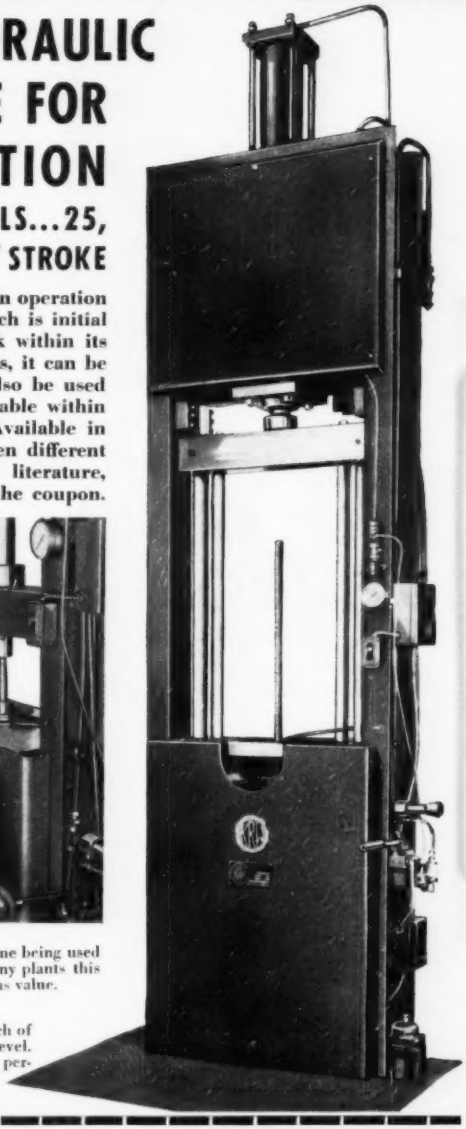
VERTICAL OR HORIZONTAL MODELS...25, 50, 60-TON CAPACITIES, UP TO 48" STROKE

You have to see this new KRW Broaching Machine in operation to appreciate its many features not the least of which is initial cost. This broaching machine will handle any work within its stroke and working capacity. In a matter of seconds, it can be changed from "Push" to "Pull" operation. It can also be used as a press. Pressures and stroke are infinitely variable within rated capacity. Electrical controls are standard. Available in either vertical or horizontal models. Choice of Ten different hydraulic pump combinations. Write for detailed literature, specifications and prices of standard models. Use the coupon.



The KRW Broaching Machine being used as a hydraulic press. In many plants this feature is a definite plus value.



All controls within convenient reach of the operator. Pressure gauge at eye level. Manually operated four-way valve permits instant and precise finger-tip control of ram. Every control readily accessible.

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K. R. WILSON, 215 Main St., Buffalo 3, N. Y.

Please send information on KRW Hydraulic Broaching Machine. Capacity Req. 25 Ton ☐ 50 Ton ☐ 60 Ton ☐

Name_____

Address_____

City & Zone_____ State_____

11

OLIVER OF ADRIAN

510 DRILLPOINTER

Sweeping Preference

for OLIVER DRILLPOINTERS

Confirmation of industry's approval of Oliver Drillpointers is reflected in the number of Oliver machines in America's largest plants.

21 DRILLPOINTER

510 Oliver Drillpointer. . . . A *completely automatic machine that grinds a scientifically correct and theoretically perfect* drill point on drills ¼" to 3" in diameter. (Equally accurate on 2, 3 or 4 flute drills.) 510 provides variable point angles and clearances.

The Oliver 21 Drillpointer is easy to set, easy to operate, and produces an accurate drill point on drills from 3/32 to ½".

Features diamond dresser, vee belt drive, hand operated bench type, ball bearing wheel spindle. The 21 will grind many types of standard or special drill points.

MAKE US PROVE IT! . . .

Send us a few of your drills. We will grind them free of cost and prove to you the efficiency of Oliver Drillpointers.

Write for literature. (No Obligation.)

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because you can move materials much quicker. Easy one-man operation handles loads up to 6 tons . . . frees manpower for other assignments. This worm-drive electric hoist performs quietly and economically. Savings accumulated with an ElectroLift will more than pay for its installation. Complete details on the model that suits your capacity, speed and plant layout needs will be supplied by your nearby ElectroLift representative, listed in the classified telephone directory. Or write direct to:

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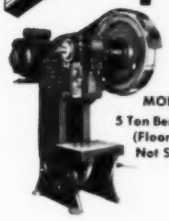
- FORMING



MODEL D
5 Ton Bench Model
(Floor Model Not Shown)

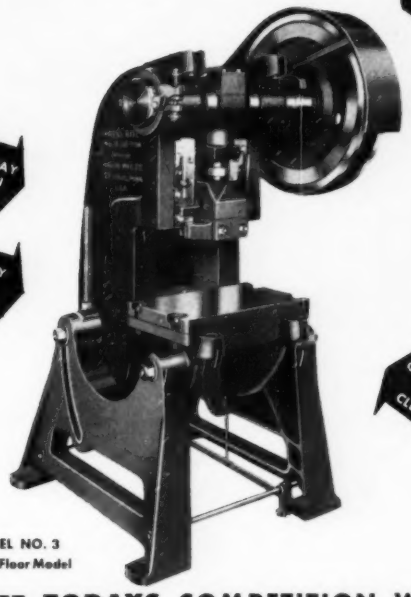
TRIPLE RAMWAY LUBRICATION

HEAVY DUTY FRAME

MODEL NO. 1
10 Ton Floor Model

MODEL NO. 2
18 Ton Floor Model

MODEL NO. 12
12 Ton Floor Model



MODEL NO. 3
30 Ton Floor Model

SAFETY MECHANISM

AUTOMATIC CAM ACTUATED BRAKE

ANTI FRICTION ROLLER BEARINGS

SLIDING KEY CLUTCH

GREATER SHUT HEIGHT CLEARANCE

MEET TODAYS COMPETITION WITH *Modern* PRESS-RITE PRESSES . . .

● Every Press-Rite Press is designed to provide efficient, low cost, volume production . . . the kind of production that meets today's severest competition . . . competition which cannot be met with yesterday's models.

You have only to check Press-Rite Press features to be assured of top performance over the entire range of press operations, from blanking to forming.

Typical of advanced design in Press-Rite Presses are their precision-made parts that increase production, give faster, safer operation with minimum "down time"—available in sizes that range from 5 to 30 tons—engineered for long trouble-free service.

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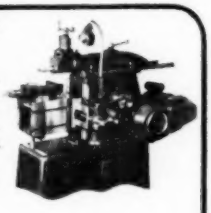

Cuts a full 8" stroke . . . handles heavy or light production jobs. Ideal for machine shops or tool and die makers. Bulletin 201-AM on request.

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Illustrated . . . Hy Duty MODEL No. 3 . . . one of 8 models, a complete line of Power Hack Saws . . . fill requirements up to 6¾" x 6¾" capacity. WRITE FOR FREE BULLETIN.

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Sales Service Machine Tool Co.

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GREER ACCUMULATOR REDUCES WORK SPOILAGE BY 24½%

TYPICAL FLASH WELDER USING GREER HYDRAULIC ACCUMULATORS

Photo Courtesy of THE FEDERAL MACHINE & WELDER CO., WARREN, OHIO, U. S. A

A leading manufacturer of large diameter drills was faced with a problem of work spoilage amounting to 25% of production. This scrap was due to insufficient oil under pressure to cope with the upset requirements of the welder used.

A 2½ gallon Greer Accumulator was installed in the circuit. No other components were changed. Immediately the work spoilage was reduced to ½ of 1%.

This is but one of numerous applications where Greer Accumulators are reducing operating cost, increasing production and improving efficiency of processes and machines.

United States Patents Under Olear Licenses

Sizes from 2 cu. in. to 10 gals., pressures up to 3000 psi.

Get the complete story by writing for our free booklet, Bulletin 200.

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HYDRAULICS INC.

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THE CASE OF THE UNIDENTIFIED ALLOY

. . . of rising importance to Metalworking as its use of alloys continues ot expand . . . is well on the way to successful solution.

"Rapid Tests for Identifying Alloy Steels," a Special Report from the February 24 *AMERICAN MACHINIST*, a sure, rapid, economical method for identifying valuable alloy steels which have lost their identifying markings is explained by Elbert C. Kirkham, one of the country's outstanding authorities on spot testing of metals.

Seventy-first of our Special Reports since war's end, "Rapid Tests for Identifying Alloy Steels" is another graphic example of how *AMERICAN MACHINIST* brings metalworking production management a steady flow of authoritative help in promoting a better, more economical use of every important material of manufacture. Whether it be ferrous or non-ferrous metals or plasties Metalworking turns *first* to *AMERICAN MACHINIST* for the information it needs and seeks.

Reprints of this helpful article are availabe at 20 cents each, or 18 cents each in quantities of 100 or more.

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American Machinist

The McGraw-Hill Magazine of Mealworking Production
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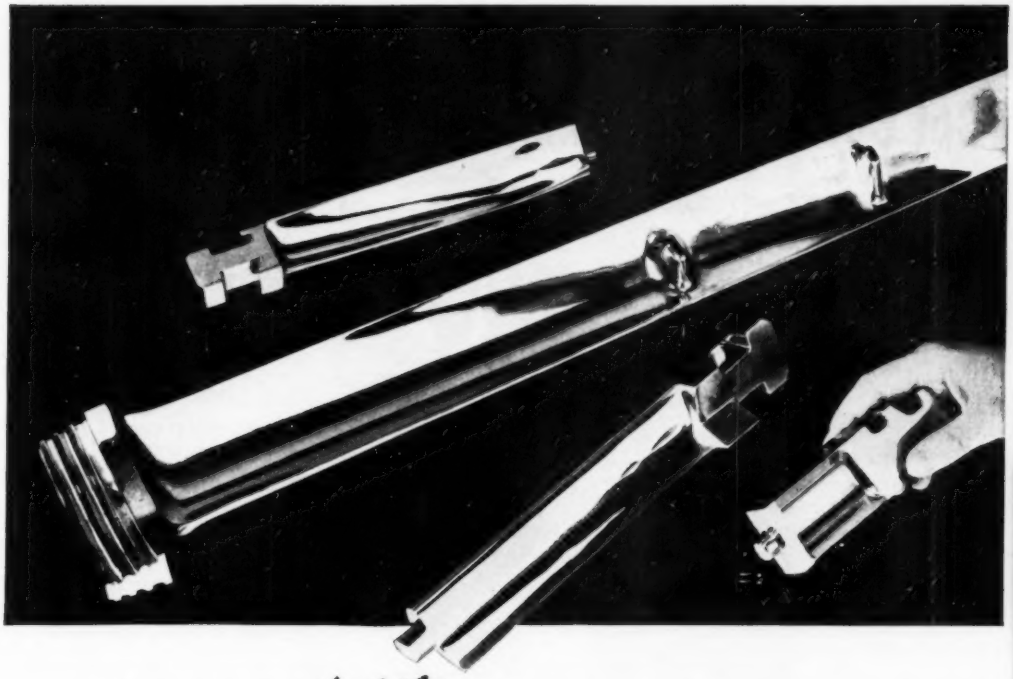

Where *workability* takes equal importance with Strength, Toughness, Corrosion-Resistance

High strength, toughness and corrosion-resistance make stainless steel the ideal material for steam turbine blades—but there's another quality needed, too—WORKABILITY. And you'll find it well developed in Republic ENDURO.

ENDURO responds uniformly in forging—as demonstrated by the largest blade above which was forged from a 7½" x 3" bar. All four blades indicate that a substantial amount of machining was necessary—and here again ENDURO shines, particularly in the free-machining grades.

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Write us for further information on Republic ENDURO Stainless Steel Bars—both hot rolled and cold finished—also ENDURO wire.

A VALUABLE AID FOR MACHINISTS

This handy Speed and Feed Selector will help you in machining stainless steel. Send for one TODAY—IT'S FREE.

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FREE-MACHINING
STAINLESS STEEL

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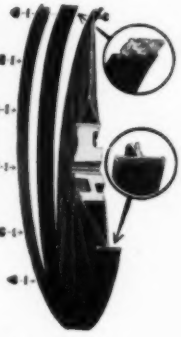
CARTER ACCESSORIES HELP YOU Cut Costs in Quick Methods

Immediately, you get more production, less shut-down time and BETTER work from use of Carter Accessories.

Carter Micro-Precision Guides . . . for band saw machines, set close to work, prevent blade breakage, produce more accurate work, speed production. When equipped with Templet Pins, save mark-up time.

Carter Rigid Band Saw Wheels and Quick Change Tires . . . can be operated at vastly greater speeds; tough, resilient rubber tires wear longer, prevent slippage and cannot be thrown. With Carter demountable rims . . . tires can be changed in 10 minutes. Practically no shut-down time. Climate has no effect.



Carter Guide Line Lights . . . aligned with straight line rip saws, indicate proposed path of saw, save spoilage, save materials, save labor, assure maximum salvage and speed production. Applicable whenever a guide line is needed.

Applications adaptable to your plant will be explained without obligation. Ask for FREE Bulletin "A.M."

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Turret Tool Posts

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HOLD THEM WITH ENCO TURRETS FOR 9" to 42" LATHES

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Suggested Lathe Size	16" to 24"	14" to 20"	13" to 19"	13" to 16"	12" to 15"	10" to 13"
Tool Block Size	6½" sq.	6" sq.	4½" sq.	4½" sq.	3½" sq.	3½" sq.
Solid Tool Capacity	1½"	1¼"	1"	¾"	⅝"	½"
Price	$138.50	103.50	66.50	53.50	46.00	36.75

WRITE FOR CATALOGUE NO. 48 WHICH SHOWS TYPICAL APPLICATION PHOTOS OF MANY OF ENCO'S 35 MODELS ON ACTUAL JOBS.

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"Non-destructive Testing Methods", a 24-page *American Machinist* Special Report, gives all the facts on how to scientifically test parts, pieces, structural materials, rough castings, dies, and any other formed piece subject to defect.

This Special Report explains in detail the supersonic, radiographic, spectroscopic and magnetic methods of Inspection . . . points out how each can be used effectively. Illustrations, graphs, photographs, clarify the factual authoritative text.

Non-destructive testing, recognized as the most practical way of checking on a production basis, is particularly important because a thorough check at all points is possible without damage to the part or material being tested. This compact, up-to-the-minute survey on non-destructive testing goes into the many new or improved methods used today, points out their particular advantages.

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The McGraw-Hill Magazine of Metalworking Production

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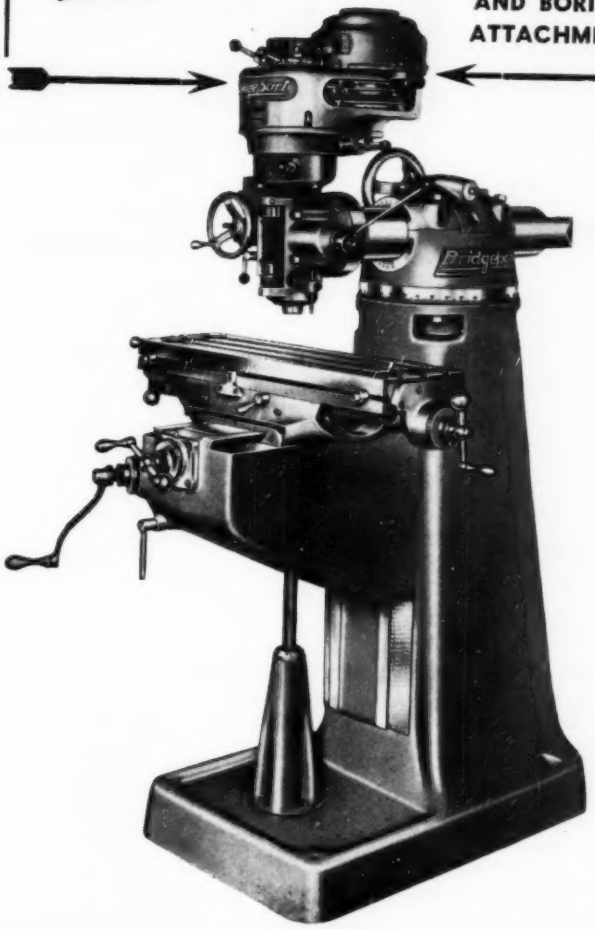
Extend the scope of lower-cost, up-to-date production . . . with the Bridgeport

1 H.P. MILLING, DRILLING AND BORING ATTACHMENT



A NEW UNIT FOR HEAVY DUTY NEEDS

With the advent of this NEW "BRIDGEPORT" attachment, die, tool, mold and metal working shops of all kinds can modernize the handling of heavier work.

All the advantages in milling, drilling and boring the "Bridgeport Way", as demonstrated in the more than 11,000 universally popular standard Milling Attachments now in service, are made available in this heavy duty unit. Capacity, speed and convenience make past methods obsolete and assure higher production at lower cost.

Here are a few of the reasons for the outstanding performance of this NEW attachment:

- . . . eight spindle speeds, from 80 to 2720 RPM are provided
- . . . spindle drive unit is back geared and designed to utilize full horse-power at all speeds without belt slippage
- . . . quill travel: 5"
- . . . three steps of power feed to quill: .0015-.003-.006 inch per spindle revolution
- . . . positive 2-way power feed stop tripping mechanism
- . . . convenient changing of tools provided by spindle brake and lock
- . . . collet capacity up to ¾" diameter

Further and complete details available promptly on request.

EQUIPMENT AVAILABLE FOR THIS NEW UNIT

Holders for shell mills
Fly cutting heads
#2 "Bridgeport" Boring Head

Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

F-12A

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IT'S **news...**

IT'S WORTH STOPPING TO SEE!

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To be well-informed about the latest developments in *your* business, *your* industry... and to stay well-informed... *read all the ads too.*

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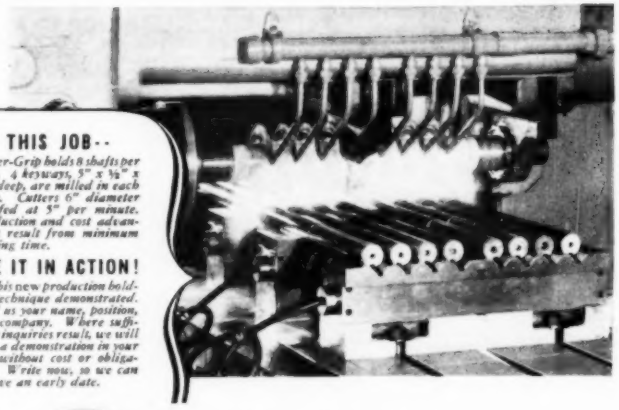
LOOK - NO CLAMPS!



ON THIS JOB--

Power-Grip holds 8 shafts per load. 4 keyways, 5" x 3/8" x 1/4" deep, are milled in each shaft. Cutters 6" diameter are fed at 5" per minute. Production and cost advantages result from minimum loading time.

SEE IT IN ACTION!

See this new production holding technique demonstrated. Send us your name, position, and company. Where sufficient inquiries result, we will plan a demonstration in your city without cost or obligation. Write now, so we can reserve an early date.

With DEEP MAGNETIC PENETRATION A NEW PRODUCTION HOLDING TECHNIQUE

That's right! Power-Grip Holding, with its Deep Magnetic Penetration eliminates the need for complex, expensive, holding fixtures, and grips securely odd shaped pieces otherwise normally difficult to hold.

Applied to milling, turning, shaping, planing, or grinding operations, this *new* holding technique is used for stout, high speed machining cuts. Get the complete story today. Write for a copy of our latest Bulletin, Magnetic Holding Methods.

Send us prints and specifications for estimates on Power-Grip Holding for your Production Jobs

SUNDSTRAND MAGNETIC POWER-GRIP CHUCKS

SUNDSTRAND MAGNETIC PRODUCTS CO.
Division of Sundstrand Machine Tool Co.
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CARBIDE TOOL GRINDER

FEATURES:

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- 9000 RPM spindle uses smaller Diamond wheels.
- Equipped for wet grinding.
- Single End Model also available.
- Shipped complete with Diamond wheels.

Let us show you how your production can be increased at no cost to you.

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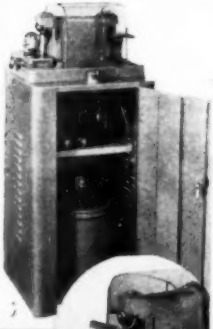
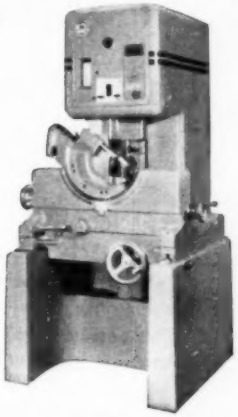


UNITED STATES DIAMOND WHEEL
AURORA CO. ILLINOIS

Kodak Conju-Gage, Model 8U, tests gears up to 8¼ inches in diameter. Smaller models check gears up to 1¼ inches and 4⅛ inches, respectively, in pitch diameter.



STEP UP GEAR QUALITY— CUT DOWN ON MASTERS

● In precision checking of gears, a single Kodak Conju-Gage Worm Section takes the place of many master gears—yet costs about the same as one.

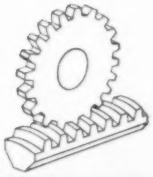
The Kodak Conju-Gage Worm Section is a gaging element produced by thread grinding to tolerances impracticably difficult to maintain in circular masters. It is accurately conjugate to spur or helical gears of any helix angle and any diameter as long as they have the same normal pitch and pressure angle. It can also test gears with different amounts of backlash.

What's more, the Kodak Conju-Gage Worm Section itself is easily checked for accuracy and can be reground repeatedly to its original specifications.

So here is the way to save on testing and at the same time stop rejecting good gears or passing poor ones. For the inherently greater accuracy of the Kodak Conju-Gage Worm Section as compared with circular masters insures your gear shop against "tolerance robbery."

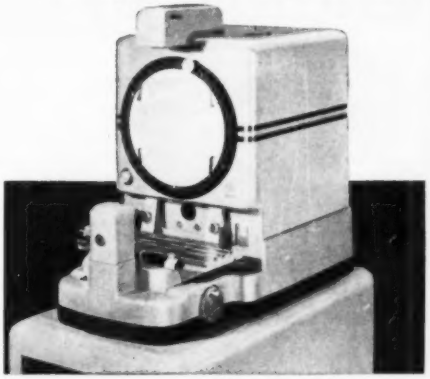
To get full details about Kodak Conju-Gages—how they work . . . save gears and money, write to

KODAK CONJU-GAGE



Kodak

Kodak Announces a New Inspection Instrument



KODAK CONTOUR PROJECTOR

gives you Precision at Low Cost by Inspecting with a Beam of Light

● Now optical projection comes out of the tool-room and takes its place on the production line.

Now this method of inspecting a part by looking at its enlarged image on a tolerance-marked screen can be used widely for accurate quality control.

Because Kodak has developed an instrument that can be used by inspectors of limited experience. They can work in fully lighted rooms, without hoods or curtains, because the screen has unmatched brilliance and yet has no "hot spot."

There's plenty of room for efficient work-staging fixtures in the unprecedented 8 inches of space from lens to focal plane for magnifications up to 100X.

Another unique feature of the Kodak Contour Projector is an optical system for illuminating surfaces and blind holes directly from the lens itself without unwieldy oblique light sources. By the flip of a switch you're ready to inspect dimensions that cannot be silhouetted. By the twirl of a dial you make your choice of five magnifications, each free from any measurable distortion, each free of color fringing in white light.

Write for the facts on this moderately priced instrument for speeding inspection and improving product reliability.

KODAK CONTOUR PROJECTOR

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Kodak

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METAL CUTTING BAND SAW

$245.00
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★ 6" x 10" CAPACITY
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★ ½ MINUTE BLADE CHANGES
★ UNOBSTRUCTED VIEW OF CUTTING OPERATION
★ CONSTANT, CONTROLLED PRESSURE ON CUTS

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The 610-S has 4 legs for greater stability, weighs 198 lbs. for complete portability. Uses any standard motor (⅓ HP 110/60/1).

Write today for full details on this outstanding low cost saw.

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"Davis" Keyseaters will handle both straight and tapered keyways in all kinds of bores. Work is easy to set and operation is extremely simple. Made in three sizes for keyways from 1/16" to 1" wide.

Illustrated literature available promptly on request.

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Precision Die Made — Lowest Possible Cost.

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RIVETERS — PIONEERS in their line—head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

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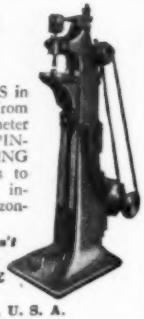

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Any MICROMETER 1" to 18" size trued and lapped square

Pearson Precision "Micrometer Lapping Fixture" gives your plant constant *exact check* on all micrometers. Any good toolroom man can operate it expertly. No disassembling of micrometer other than removing spindle. Laps micrometer in exact right angle with center line of spindle; and in perfect alignment with end of micrometer spindle. Also makes an excellent comparator. Saving an hour's rejects may more than pay for this fixture. "This fixture will also accurately lap adjusting snap gauges with addition of a new holding bracket."

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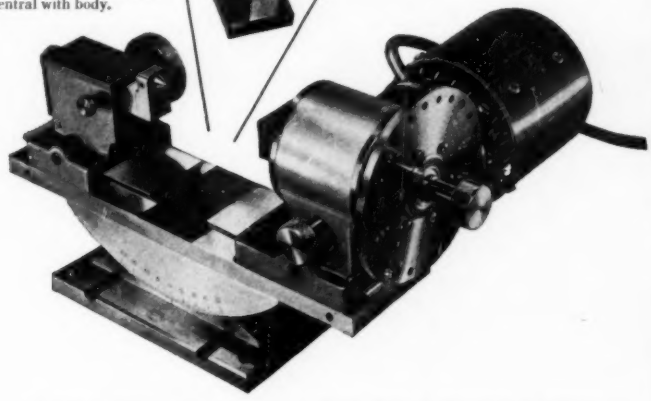
Save on small grinding jobs with Moore Motorized Centers

All ground in one set-up. These parts illustrate wide variety of Motorized Centers' work. Small punch in top row has a rectangular end 1/32" x 3/32", ground central with body.



New toolroom attachment for surface grinders, jig borers, drill presses, millers, etc., handles flat, curved or circular work in one setting.

You'll wonder how you ever got along without this portable, precision-built grinding accessory. No longer is it necessary to tie up large, expensive machines to grind square and round punches...do taper grinding, index grinding and face-plate work.

Motorized Centers can be set on a surface grinder chuck in a jiffy and the job completed quicker than the grinding wheel on a large machine can be changed. Think of the resulting savings in costly toolroom labor and materials.

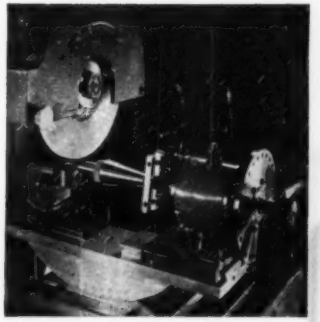
With it, in one setting, you can now grind flat, curved or circular work—in any combination of taper or contour—all within .0005". The index plate allows indexing in the same operation, too. Tapers can be reversed or changed by loosening two screws in the rocking bed, and the index plate can be engaged by merely pressing a plunger. The simple tail-stock center readily permits the use of specials—male, female or cutaway.

CATALOG WITH 20 ACTION PHOTOGRAPHS will show you graphically how you can use this versatile tool for production and inspection, too. In it are examples of some of the many difficult toolroom jobs you can handle easily: double tapers, equally spaced slots, small cylindrically tapered punches and many others. It's yours for the asking.

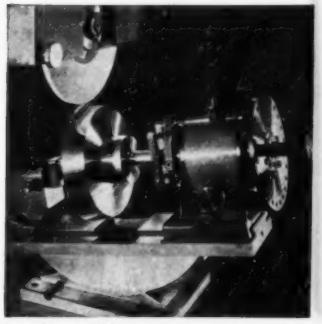
SPECIFICATIONS

Length—overall	12"
Width—including motor	10"
Height—overall	8"
Distance between centers—maximum	6"
Centers will swing	6"
Maximum grinding angle (using 10" angle block)	30°
Motor	1/25 H.P., 115 volt, 60 cycle

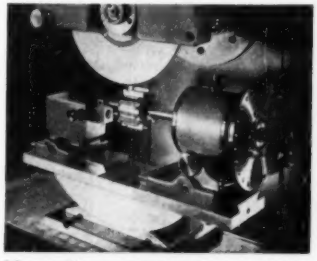
MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Conn.



Double tapers and hex shoulder ground with a single set-up. Rocking bed is equipped with a tangential screw for fine-setting taper angles.



Grinding a 10° taper on a machine part 5" long, 5" in diameter on centers.



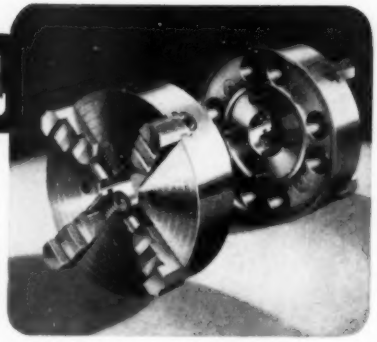
12 equally spaced slots in punch holder ground by using index plate.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

SKINNER

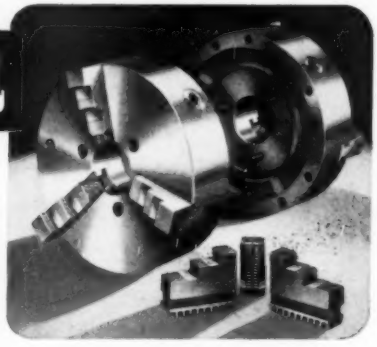
INDEPENDENT CHUCKS



Models for medium and heavy duty tool room and general machine shop work. Available in sizes from 4½" to 36" with semi-steel, steel, or forged steel bodies. All other parts are heat-treated alloy steel. Jaws are solid reversible or two-piece with reversible tops for either internal or external gripping. The body surrounds more than 60% of each operating screw for the full length of the screw to assure proper alignment at all times.

SKINNER

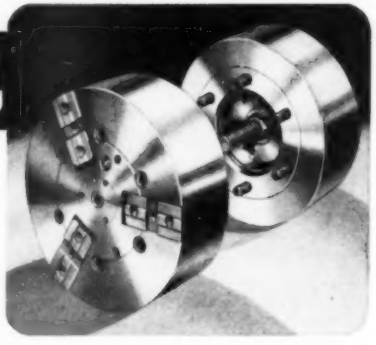
SCROLL CHUCKS



Self-centering models for light, medium and heavy duty jobs in tool room or for production runs. Available in sizes from 3" to 21" with semi-steel or forged steel bodies, and heat-treated alloy steel for all other parts. Provided with two sets of solid jaws or two-piece jaws for holding internal or external work. Lands on the jaw, jaw steps and end bites are ground after the chuck is assembled.

SKINNER

POWER CHUCKS



Self-centering models for heavy duty production work on engine and turret lathes and automatic machines. Sizes from 6" to 21" with forged steel bodies, and with either 2 or 3 non-adjustable jaws are available. The wedge angle is such that work is gripped positively regardless of jaw position. The chuck will not release the work, even if air line is broken, until operator actuates draw bar. Skinner also has a complete line of power chucking accessories.

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Hand and Power Operated Machine Chucks—Air Chuck Equipment—Face Plate Jaws—Machine Vises—Complete details in free Catalog No. 61.

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Every issue is a catalog of goods, materials, and services — quickly available to you—just for the reading.

Leaders in business and industry turn to the advertising because they've discovered it helps them run their businesses more profitably.

When you read all the ads in this magazine, the chances are good that you'll get a lead that will materially help you do a better job. For example, you may find a specific piece of equipment that will be a profitable time-saver. Or a tool that will increase worker efficiency. That's why it pays to read the advertising. It's good business.

HEADQUARTERS FOR BUSINESS INFORMATION

McGRAW-HILL publications

F-25

HIGHER PRODUCTION? *Yes!*

LOWER COSTS? *Yes!* — and ACCURACY BESIDES

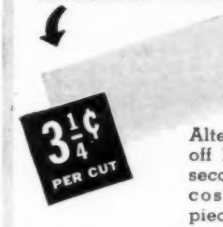
with the MOTCH & MERRYWEATHER NO. 2-A CIRCULAR SAWING MACHINE

Triple-Chip METHOD

Triple-Chip Method cut off 490 pieces in 50 seconds per cut at a cost of $.0101 per piece.

TRIPLE-CHIP vs. ALTERNATE METHOD

(Sawing SAE 1020 5" O. D.)



Alternate method cut off 100 pieces in 235 seconds per cut at a cost of $.0325 per piece.

As with all Motch & Merryweather Circular Sawing Machines, the No. 2-A (automatic) brings you all the advantages of the Triple-Chip Method. Stock up to 6" is sawed accurately to length without burrs, giving a mill-type finish, which eliminates second operations. Work is held rigidly on both sides of the blade. With the M. & M. Triple-Chip Saw Blade, correctly sharpened by the No. 1 Automatic Grinder, maximum cut-off speed and accuracy are attained. *Ask us to furnish you with cutting time figures.*

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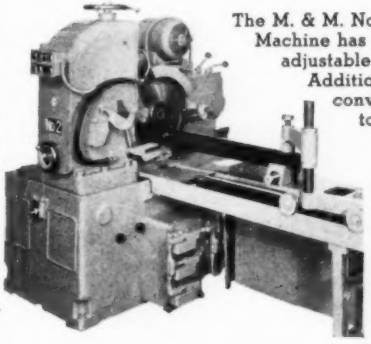

The M. & M. No. 2-A Circular Sawing Machine has automatic, micrometer adjustable-stop bar feed to 36". Additional stroke lengths and conveyor can be furnished to accommodate long length bars.

• • •

A complete range of circular sawing machines is available for stock up to 16½" round as well as special machines to meet your requirements.

Write on your letterhead for Bulletin No. 2-A.

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How to read with your eyes open for business!

Read the ads! Every issue of this magazine contains ads that offer valuable services and useful products by which your business may be run more profitably.

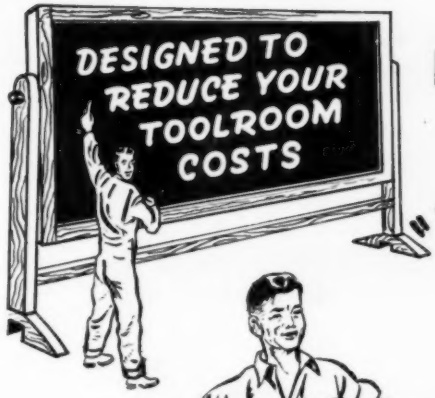
The time it takes to read all the ads is time well spent. One ad alone can pay off — by informing you of new developments and new sources of supply, by helping you do a more efficient job. For example, you may locate one machine that will cut your production costs, or step up your output. Or you may discover that the equipment you've been waiting for is now available.

This magazine displays more ideas and merchandise than a trade exposition. Make every issue your buyer's guide. Read the ads as well as the articles. That's reading with your eyes open for business.

HEADQUARTERS FOR BUSINESS INFORMATION

McGRAW-HILL publications

F-24



RIVETT'S *great new* "TOOLROOM TEAM"

RIVETT 1024 UNIVERSAL HYDRAULIC GRINDER

New swiveling double-end wheelhead mounts both internal and external spindles . . . slashes set-up and conversion time . . . sealed and pre-lubricated internal spindles offer speed range from 6,000 to 35,000 rpm . . . external spindle has pre-loaded bearings requiring no adjustment . . . lathe type workhead spindle — mounts draw-in collets and step chucks directly . . . micrometer table stop . . . standard 5" sine bar sets workhead or table swivel for perfect tapers.

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Combines the sensitivity of an instrument lathe with the heavy ruggedness of an engine lathe . . . 12½" swing, 20" center distance, weight 4,000 lbs. (40% heavier than comparable lathes) . . . back gearing for turning power and belt drive for high spindle speeds . . . wide steelway bed to absorb force of heavy cut . . . dial adjusting gear box develops 72 threads and feeds.

A new Rivett team — an unbeatable team — to speed work, increase precision and cut costs in your toolroom. Individually the 1020S Lathe and the 1024 Grinder are loaded with new features and together they offer interchangeability of work holding fixtures. Look to one source for your toolroom turning and grinding.

A few of the highlights are given here (above and left). Read them — then get *all* the details by writing today for descriptive bulletins.

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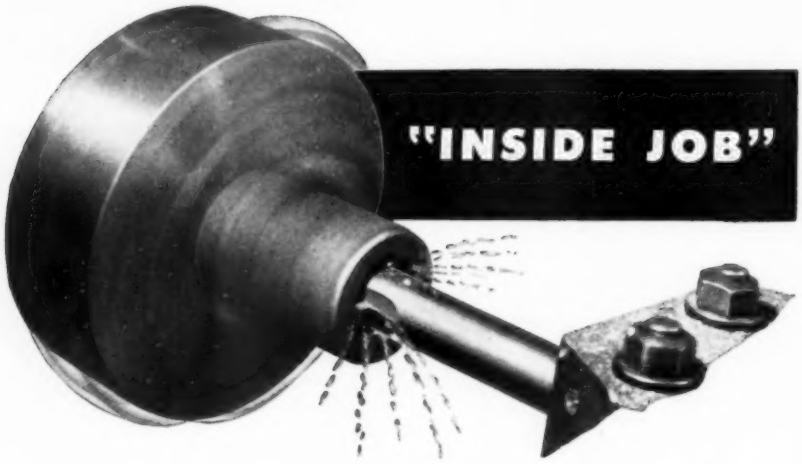


with MADISON boring tools

THERE'S A MADISON FOR EVERY BORING OPERATION

ROUGH BORING TOOL

This tool, in many cases, will remove as much stock in one pass as an ordinary single point tool in three passes . . . and at faster speeds.

FINISH BORING TOOL

A tool that works to close tolerances at high production speeds . . . yet still gives a superior, mirror-smooth finish.

COMBINATION BOREAMER

Combines the roughing and finishing tool in one bar . . . does the whole job in one pass of the tool. This definitely steps up production.

Write for the new Madison Catalog

Madisons have won a reputation for lowering hole costs through speed, accuracy, and simplicity of operation. Recently a group of veteran tool men were asked this simple question, point blank, "Why Use Madison?" Their replies, as follows, indicate several sound and basic advantages in Madisons that can't miss cutting down costs in any operation.

1. **Superior finishes,** in many cases equaled only by "hand finishing." **Tolerances** to .0003.
2. More holes per cutter before regrinding.
3. More regrinds per cutter (about 10 times as many as similar tools).
4. Faster regrind.
5. Cutter may be floated in the bar — bar remains stationary. No special floating holders needed.

TAKES ONLY SECONDS TO CHANGE A MADISON CUTTER

A Madison cutter may be quickly removed from the bar and set to a different diameter, or replaced by a sharpened cutter. Merely loosen screws "A" and "B", slip out old cutter, put in new cutter, tighten screws. Work is not disturbed.

MADISON MANUFACTURING COMPANY
DEPT. AM **MUSKEGON, MICHIGAN**

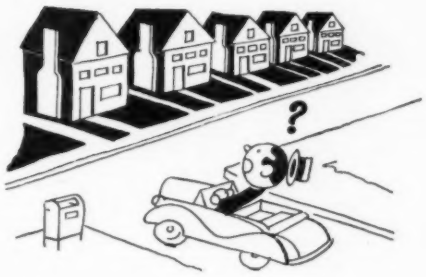
How to keep costs down with OZALID

Your Ozalid operation *should* be the simplest, most inexpensive business system in your organization.

If it isn't, check these two factors:

1. Always use Ozalid sensitized materials in your Ozalid machine. Month after month, package after package, Ozalid materials are *uniform*. Printing speed, fade-resistance, physical strength, density, and eleven other characteristics are kept in scrupulous balance so that one batch of paper gives you the same results as the last one ... or the next one!

Thus your Ozalid operator's time is spent in printing —not in studying the characteristics of vastly differing diazo materials.



2. Ozalid's nationwide service organization is as near as your telephone book. Let these trained technicians and business wizards keep your Ozalid operation in tiptop form. They'll keep your Ozalid machine in super-efficient working condition, as well as help you set up new methods of getting more work done with less effort ... through Ozalid!

If you have an Ozalid machine, are using Ozalid materials and taking advantage of the national Ozalid service organization ... *you're saving time and money!*

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This spindle bearing is standard equipment on large spindles designed by a world-famous builder of precision grinders. For extreme accuracy, for freedom from vibration, and for enduring precision, only sleeve bearings will do. Where other types of bearing retain their accuracy only for months, Bunting Spindle Bearings endure for years. Where other complex types require a surgical standard of cleanliness and a watchmaker's skill for replacement, the Bunting Sleeve Bearing requires only common-sense and the services of a good mechanic.
The secret of this performance and long life lies in the film type of lubrication. A properly designed and well lubricated sleeve bearing need not acknowledge any superior. No other bearing type possesses its simplicity, its ruggedness, its ability to deliver accurate work for many years. These attributes are possessed by the sleeve bearing.
Bunting engineers are at your service whether your problem is a precision grinder spindle, an aircraft engine, an automobile engine, or something of more or of less exacting requirements. Bunting engineers utilize their extensive experience with bearings of all types in their work of designing Bunting Cast Bronze Sleeve Bearings. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in Principal Cities.
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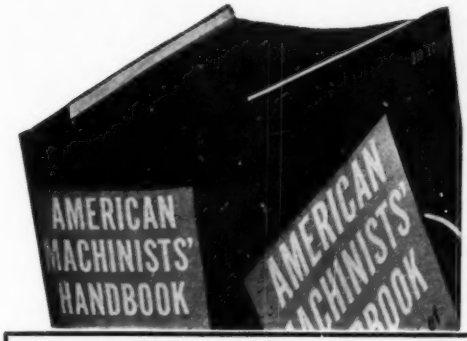
76

The answers to hundreds of questions on machine-shop standards and practice—

in everyday machine-shop work



HERE is a standard and universally-used technical handbook, an indispensable tool for everyday machine-shop work. Over 1500 pages of clear, concise, constantly useful data—the book recognized everywhere as the standard manual of data, methods and definitions for apprentices, machinists, toolmakers, draftsmen, designers, foremen, superintendents, and all others who need dependable, up-to-date material in the machine-shop and metalworking field.

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Gives you the benefit of many time and material saving shortcuts developed in actual shop work.

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By FRED H. COLVIN
Editor Emeritus, *American Machinist*
and FRANK A. STANLEY
Formerly Editor, *Western Machinery and Steel World*

Which section will you use most?

The following is only a list of main section headings. The big 12-page index makes easily accessible the hundreds of more detailed topics—accurate, dependable facts, figures and methods in all of these sections.

1. Screw Threads
2. Pipe and Pipe Threads
3. Drilling
4. Reamers and Reaming
5. Taps and Tapping
6. Files and Work Benches
7. Babbitting, Brazing, Soldering and Welding
8. Gearing
9. Turning and Boring
10. Milling Machine Feeds and Speeds
11. Grinding, Honing and Lapping
12. Screw Machine Tools, Speeds
13. Punch Press Tools
14. Broaches and Broaching
15. Bolts, Nuts and Screws
16. Measuring and Fitting
17. Tapers and Dovetails
18. Shop and Drawing Room Standards
19. Wire Gages and Stock Weights
20. Horse-power, Belts and Shafting
21. Metals and Other Materials
22. Machine Forgings
23. Knots and Slings
24. General Reference Tables
25. Automotive Data
26. Railroad Shop Data
27. Shop Trigonometry
28. Dictionary of Shop Terms

JUST where can any worker find as much and so wide a variety of helpful material as is given in this well-planned and well-organized handbook? Just think of being able to find the answer—the *right* answer—to any question—*quickly*—layouts, speeds, feeds, tools, jigs, fixtures, materials, standards, tolerances—any detail of machine-shop or drafting-room practice. In one handy, compact volume this Handbook fills all your reference needs.

Helps you with other men's experience

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—information on highspeed or hyper-milling
—data on negative rake angles for cutting steel, with details on care of cutters
—calculation for circular form tools
—thread lobes for screw-machine cams
—the Guerin process for cutting and forming sheet metals
—suggested cutter angles for turret lathe work
—adaptation of older machines to use of carbide tooling
—plastics used in forming dies
—procedure in atomic hydrogen welding
—advantages of glass gages
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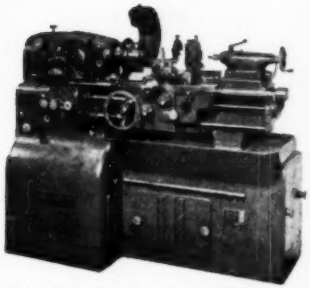


10"x20" Model #EE Monarch Precision Toolmakers Lathe. Late Type. W/Taper Attach. Collets, chucks, toolholders, tool cabinet.

ENGINE LATHES

LeBlond 36"x30' Q.C.G. Hvy. Duty Geared Head Screw Cutting Engine Lathe. Serial #NK-230. 12 Speed Head. 36" internal grd. faceplate, Taper Attachment, Dial Thrdg. Set of toolholders. Max Swing—39". Centers—22'6". 25 h.p. 3/60/220/440 volts V-belt drive.

24"x16' American Q.C.G. Motorized Cone Head. 11' centers. Taper Attachment 24" chuck, faceplates, cabinet type legs. 220/440 volts motor.

18"x6' Monarch 8-Speed hd. Q.C.G. 220 volts motor. Actual swing—20¼", 20" c.c. Hex. Turret on crosslide. Cabinet legs.

16"x6' Monarch 8-Speed Hd. Q.C.G. 220 volts motor. 24" c.c. Univ. Chuck, Draw-bar & set of 16th collets and 32nd collets.

14½"x6' South Bend Enclosed Head, Motor Driven. Taper Attachment, Chucks, Turret Toolpost Threading Dial, Ram Type Turret Attachment, Collets & Collet Chuck.

14"x8' Reed-Prentice Eight Speed Selective Geared Head, Q.C.G. Motor driven w/220/440 volts motor & controls. Has Taper Att. chuck, faceplates, steady rest, cabinet legs, max. centers —48". Completely rebuilt. Immediate shipment.

Extension Bed Gap Lathe, 20"-44"x10' Putnam Q.C.G. 220/440 motor. Faceplates & Chuck.

Bliss-Consolidated #77 Motor Driven Open Back Gap Frame Single Crank Single Action Backgeared Power Press. Has Automatic Roll Feed & Roll Straightener, also Ejector under Bed. 160 Tons Cap. 10" Stroke. Tie Rods & Inclined Base.

TURRET LATHES

Bardons & Oliver #1 Electric Turret Lathe. ¾" cap. Has bar feed & collets.

Morey #2 Geared Head 1" Cap., M. Dr.

Simmons Microspeed 1" Cap., M. Dr.

Oster #601 Hand Screw, Machine 1½" cap.

W-Swasey #4 Univ. 1½" cap., M. Dr.

Jones & Lamson #3 Univ. Bar Feed 1½".

W-Swasey #3 Univ. 1½" cap., M. Dr.

Bardons & Oliver #7, Univ. 2½" Cap.

W-Swasey #3A Univ. 3½" cap., M. Dr.

Warner & Swasey #1A Universal Heavy Duty Saddle Type Turret Lathe. Serial #648220. Capacity —2½" rd., Gr. Hd. 12 speeds. Coolant system, bar feed, chuck & tooling. Immediate delivery.

GRINDING MACHINES

Blanchard #16 Motor Driven Vertical Rotary Surface Grinder. 26" Chuck with power down feed.

Cincinnati 10"x36" Plain Hydraulic Cylindrical Model #EA. Serial #5P2D1L-19. Filmatic Bearings. Built-in Electrics. Hydraulic Infeed.

Heald #22 & #25, 12" & 16" Horizontal Rotary Surface Grinders. Motor driven.

Cincinnati 'Monoset' Model #OE Cutter & Tool Grinder, Motor driven. With motors & controls. Set of collets, taper & cylindrical and equip.

Thompson 6x18 Hydraulic Horiz. Surface. Wet & dry work. 220/440 motor driven. Auto. downfeed to head. Motor driven exhauster unit.

#2 Cincinnati Universal Tool & Cutter Grinder. Late Type. Univer. Motor Driven Workhead, Diamond Bracket, etc. 220/440 volts motor.

Norton 6x18 Vertical Rotary Automatic Surface Grinders. 220/440 volts motors. Excello Spindles. Hydraulic Table feeds. Three Available with immediate delivery. Also 6x18 Horizontal.

Mattison 12" x 16" x 48" Motor Driven Precision Hydraulic Horizontal Surface Grinder. Serial #13025. Excellent condition. 220/440 motors. W/12" x 148" Chuck & G.E. Generator. Built-in push button controls. ONE AVAILABLE.

Norton #2 Cutter & Tool. New—1943. W/Equip.

B & Sharpe #13 Univ. & Tool. 220 Volts.

Heald #22, 12" Horiz. Rotary. 220/440 volts.

AUTOMATICS

#OG & #00 Brown & Sharpe Automatic.

#2G Brown & Sharpe Standard Speed. 220/440 volts motor & push button.

#2 Brown & Sharpe Automatic Turner drive 220/440 volts motor. With Stock.

Cleveland Model "A" 3¾" capacity Single Spindle Motor Driven Automatic. Has lot of tooling, collets, motors and switches & coolant system. 1943.

PUNCH PRESSES

O.B.I. Johnson (NEW) all sizes, geared & plain

O.B.I. Toledo #5, 44 tons cap. motor dr.

O.B.I. Bliss #18, 19C, 20, 20B, 21 motorized.

O.B.I. Michigan, 36 tons cap. Wide ram & bed.

#39B Bliss Horn. 220/440 motor.

#68C Bliss Dble. Action 3-Crank.

#91C Toledo Sgle. Act. Dble. Crank S.S.

#305 Bliss S.S.S.A. 95 Tons Cap.

#15H Rousselle Horn. 220/440 motor.

#3A Bliss S.A.S.S. Dble. Crank.

Zeh & Hahneman 35 Tons S.A. Cam Release Spring Return. 220/440 motor.

BETTS 100" Vertical Boring and Turning Mill. 1944 Machine. 2 Plain Heads. Complete electrical equipment. Excellent condition. Immediate delivery.

MILLING MACHINES

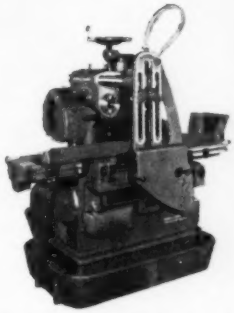
Cincinnati #3, #4, #5 Pl. Horiz.

Brown & Sharpe #0, 1, 1Y Horizontal.

Cincinnati 18" Mfg. Plain.

Milwaukee #2K Vertical, M. Dr. Dial Type.

Milwaukee #3K Vertical, M. Dr. Dial Type.



Brown & Sharpe #12 (Electrics built-in) Late Type Milling Machine. 24" Table Travel. Motor driven coolant. Also 18" travel machines. Immediate shipment.

MILLING MACHINES—Cont.

Milwaukee #2B Dbl. Overarm, Horiz.

#3 Dial Type, H.S. Cincinnati Vertical Mill. Power Rapid Traverse, speeds up to 1300 r.p.m. Range—34"x16"x16" Head has 6" vertical with four stop indicator. Serial #4A3V1L-61. Timken Bearing. 10 h.p. motor drive in base.

#3V Van Norman Ram Type Vert. Late Type.

#2, #3, #4 Cincinnati High Power Vert.

#4-36 Cincinnati 4-Spdle. Duplex Hydromatic.

#4-36 Cincinnati Plain Hydromatic.

UNIVERSAL MILLING MACHINES

B & S #2, 20"x5"x17½".

B & S #1½, 20"x7"x18".

Bridgeport, 20"x9"x16" Turret Type.

Garvin #2MU, 24"x8"x18".

Kempsmith #2, 28"x8½"x18".

Cincinnati #2M, 28"x10"x18".

B & S #3, 34"x10"x21".

Cincinnati #3S 34"x12"x20".

Some w/index heads & equipment.

NEW—GEMCO 20" Universal Shaper. 220/440 motor. Power Rapid Traverse, horiz. & vert. Large Discount. Immediate shipment.

RADIAL DRILLS

Cinci-Bickford 6' Arm, 15" Col. 24 Speeds.

Cinci-Bickford 5' Arm, 13" Col. 24 speeds.

Cinci-Bickford 3' Arm, 9" Col. 12 Speeds.

Cinci-Bickford 6'-19" Super Service. New in '42. 36 Spdle. Speeds. Standard Base, plus angle base. Necessary Motors.

BORING MILLS

2½" bar Cleveland Horiz.

3⅛" bar Giddings & L. Horiz.

5" bar Barrett #2 Cylinder.

8" bar Barrett #6 Cylinder.

Ryerson #11 Horiz. 3" Capacity, #6 M.T.

24" Bullard Vertical, Motorized.

42" Bullard Vertical, Motorized.

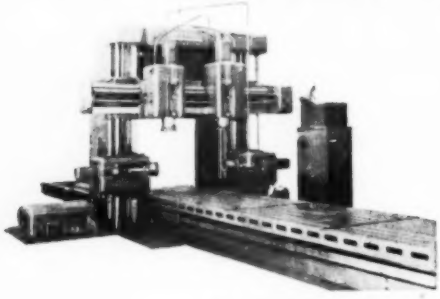
54" Bullard Vertical, Motorized.

42" Gisholt Vertical, Motorized.

60" Betts Vertical, Motorized.

SIMMONS BEST BUYS

Inspect This Planer Miller Today



72" x 72" x 30' Ingersoll Adjustable Rail Planer Type Miller with two rail heads and two side heads. Quill diameter 10" with 15" adjustment. Bed length 60' with tubular steel ways. Approximate Weight 160,000#. Inspect at Albany.

NEW YORK CITY OFFICE: 50 EAST 42nd STREET

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MAIN OFFICE AND PLANT: 1759 N. BROADWAY, ALBANY, 1, N. Y. · NEW YORK OFFICE: 50 EAST 42ND STREET

WANT GOOD TOOLS? WE HAVE THEM

No. 28L NATCO "Hole-steel" Multiple Spindle Drill.

10"x72" NORTON Type C Plain Grinder.

50"x204" centers LeBLOND "Big Swing" Engine Lathe.

DRILLING MACHINES

No. 2LMS LELAND GIFFORD, 4 spindle.
3'11" AMERICAN "Hole Wizard" Radial.
6'15" CINCINNATI BICKFORD "Super Service" Radial.

LATHES

10"x20" MONARCH "EE" Toolmakers.
14"x30" LeBLOND Heavy Duty Engine.
16"x78" AMERICAN "Pacemaker" Engine.

MISCELLANEOUS

3" bar YODER Hor. Boring Mill.
No. 145 CLEVELAND Rigid Hobber.
12" SMITH & MILLS Univ. Shaper.

MILLING MACHINES

Nos. 0B CINCINNATI Plain and Vertical.
No. 1224 K & T Simplex Miller.
No. 2HL K & T Plain Miller.
No. 2HS CINCINNATI Dial Type Vertical.
No. 3H K & T Verticals.
No. 45/48 CINCINNATI Plain Hydromatic.
No. 12B P & W 2-spindle Miller & Profiler.
4½" x 36" P & W Model C Thread Miller.

TURRET LATHES

No. 0 B & S Wire Feed Screw Machine.
No. 2 B & O Turret Lathe.
No. 3 J & L Universal Turret Lathes.
No. 4 W & S Universal Turret Lathes.
No. 4 GISHOLT Universal Turret Lathes.
No. 5 W & S Universal Turret Lathes.
No. 5 J & L Universal Turret Lathes.
No. 5 B & O Universal Turret Lathe.
No. 4A W & S Universal Turret Lathe.

WIGGLESWORTH MACHINERY COMPANY
203 BENT STREET **CAMBRIDGE, MASS.**

W-6 & W-7 BAUSH Multiple Spindle Drills.

2½" CLEVELAND Model "A" Single Spindle Automatic.

32x36x66 ROCKFORD Open - Side Shaper-Planer.

Metal Forming and Bending Machine
#200-F Toledo 155 Ton D.C. Pneu. 3" Stroke. 20" x 110" Bed Area
#6-D Potter & Johnson Turret Lathe
12 Spindle Moline Automatic Drilling Machine
3 Spindle Moline Model 7-D Cylinder Borer
1-A W&S Universal Turret Lathe
36"x14' Schumacher & Boye Engine Lathe
Libby 28"x4½" Spindle Turret Lathe
20" Stockbridge Shaper
Lees-Bradner CT 30" Thread Millers
Crankshaft Grinder
Foote-Burt 4 Spindle Drill #2 M.T.
24"—H.S. Milling Cutters (New)

CONTINENTAL SALVAGE & MACHINERY CORPORATION
1836 EUCLID AVENUE, CLEVELAND 15, OHIO
MAIN 4402

No. 25T G. & L. 2½" table Hor. Mill, 1942
4" Univ. Table Mill, 80" vert. 96" hor., '43
36" & 42" King Side Hd. Vert. Mills, '43
Nos. 1A & 3 W. & S. Turrets, bar & chuck
28/60 Cinci. Hydrotel Vert. Miller, 1 spin.
Nos. 3 & 2MH Cinci. Pl. Dial Millers, late
Nos. 3K & 3H K. & T. Pl. Dial Millers, late
No. 3B Van Norman Pl. Miller, ram, '43
No. 2G Kempsmith Univ. Miller, 1943 (3)
No. 2416 Keller Duplicator, late
No. 9J Gorton Duplicator & Vert. Miller (2)
12"x24" G. & L. No. 45 Surface Grinder, '42
No. 70A Heald Internal Grinder, 1942
Gear Cutter, No. 13 B. & S., spur & bevel
No. 6 M. & M. Keyseater, AC, M.D.
61" Bullard Maxi-Mill Vert. Boring Mill
30"x120" Hanchett Plano Surface Grinder

BENNETT MACHINERY CO.
30 Church St., New York 7, N. Y.

Nos. 1 & 3 W & S Turret Lathes
No. 2 B & S Univ. Mill, Cullman drive
No. 20 Walsh OBI Press, M.D.

D. E. DONY MACHINERY CO.
47 Laurelton Rd., Rochester 9, N. Y.

Bar. Mill, Hor. 4½" Bar N-S-P
Bar. Mills, Vert., 24"-30"-42"-60"-72".
Drills, Radial, 3'-4'-5'-6' Cin.-Bick.
Grinder Surface, #2 Diamond, Mag. chuck.
Lathes, Turret, 3A W. & S., and 24" Gisholt
Millers, Plain No. 3, 4, & 5-B Cincinnati.
Millers, Vert. No. 3 & 4 Cincinnati.
Shaper, Draw Cut, 30" Norton, 36".
Swager, 23 Etna, 1½" tubing.

West Penn Machinery Company
1210 House Bldg. Pittsburgh, Pa.

PRACTICALLY NEW

American Ring Metal Turnings Crusher, Type ST.T., Machine No. 2400, Serial No. 1924.
Capacity—Steel Turnings 2½ to 3¼ Tons Per Hr. PRICE $1500.00

WINSTON MACHINERY CO., INC.
517 South Delaware St., Indianapolis 4, Ind.

REPLACE OLD MACHINERY *NOW!*

Eastern Offers Late Model Machinery None In This List Over 10 Years Old!

• AUTOMATICS
No. 4D Potter & Johnston, m.d., latest
8 spindle 1⅝" Cone, m.d., latest
4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
20x225" Jones & Lamson, m.d., latest
4 spindle 7/8" Model R-4 Acme-Gridley, m.d.

• HORIZONTAL BORING MILLS
3½" Cincinnati-Gilbert Floor Type, m.d.
No. 25T Giddings & Lewis, m.d., 2½" bar, latest

• VERTICAL BORING MILLS
72" King, m.d., 2 swivel heads, 1 side head, latest
100" Niles Extra Heavy, m.d., p.r.t., late

• BROACHING MACHINES
75 H.P. LaPointe Horizontal Hydraulic, 150" stroke, 37½ tons cap.
Cincinnati Mill Broach, m.d., 10" spindles, new

• BALL BEARING DRILLS
Model D 1100 B Walker-Turner Bench Type, 20" size, brand new
2 spindle 28" Canady-Otto, m.d., No. 4 Taper
No. 1, 2 Avey, bolted m.d.
No. 1B Edlund, m.d., new
No. 4BM-24" Fondick, m.d., latest
No. 5M-16" Fondick, m.d.
4 spindle No. 2LMS Leland-Gifford, 26" swing, m.d. on each spindle
6 spindle 2B Edlund, m.d., No. 2 Taper

• HORIZONTAL DRILLS
Morris Horizontal Mor-Speed, m.d.
No. 1½Bx30" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. 1½Bx50" Pratt & Whitney Deep Hole Drill, m.d., latest
No. 1½Bx50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 1½Bx50" Pratt & Whitney Chambering Machine, m.d., latest
No. 1Bx74" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d., latest
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest
No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 0 Barnes Twin Spindle Honing Machine, m.d.
2 spindle No. 410 W.F. & John Barnes Deep Hole Drill, m.d.

• MULTIPLE SPINDLE DRILLS
P7 Baush Hydraulic, m.d., 20x30" head, 12 spindles, latest
D13H Natco Hydraulic, m.d., 18x12" head, 10 spindles

• RADIAL DRILLS
6'-15" American Hole Wizard, m.d. on arm

• GEAR SHAPERS
No. 7, 7A Fellows, m.d.
No. 1B Fellows Gear Finishing Machine, m.d.
No. 61A Fellows, m.d., latest type
No. 61SA Fellows, m.d.
No. 72 Fellows, m.d., latest

• GEAR GRINDERS
No. 2HS Lees-Bradner Spur & Helical, m.d.
No. 13LS Fellows Gear Lapper, m.d.

• GEAR HOBBING MACHINES
Type A Barber-Colman, m.d., latest
Type D Barber-Colman, m.d., latest
No. 12H Gould & Eberhardt Universal, m.d.

• CENTERLESS GRINDERS
No. 2 Cincinnati, m.d., Filmatic Spindle, latest
No. 3 Cincinnati, m.d., Filmatic Spindle, latest
Long bar attachment for No. 3 Centerless
Cincinnati Valve Seat Grinder, cap. ⅝" valve stems, m.d.

• PLAIN CYLINDRICAL GRINDERS
No. 5—3x18" Brown & Sharpe, m.d., latest
6x18" Cincinnati Hydraulic, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x18" Norton Type C Hydraulic, m.d., latest
6x30" Cincinnati Hydraulic, m.d.
6x32" Fitchburg Type A, m.d., late
7x11" Leach External Grinder, p.t.
8x18" Cincinnati Saddle Type, m.d.
8x36" Cincinnati Saddle Type, m.d.
10x36" Cincinnati Hydraulic, m.d.

• UNIVERSAL CYLINDRICAL
6x20" Fitchburg Hydraulic Spline & Gear Grinder, m.d., latest
12x24" Cincinnati Self-Contained, m.d., latest mechanical type
12x30" Landis Hydraulic, m.d., late type
12x48" Cincinnati, arranged for spline grinding
12x48" Cincinnati Hydraulic, m.d., latest type
12x48" Norton, m.d., latest
18x48" Cincinnati Hydraulic, m.d., latest

• INTERNAL GRINDERS
No. 16A-10" Bryant, m.d., latest
No. 16-22" Bryant, m.d., latest
No. 16RS Bryant, m.d., latest
No. 16-36" Bryant, m.d., latest
No. 24-36" Bryant, m.d., latest
No. 72AS Heald Plain, long bed type, m.d., latest
No. 73 Heald, m.d., brand new, latest
No. 74 Heald, m.d.
No. 174 Heald Gap, m.d., latest
No. 640-18 Van Norman Automatic Oscillating Radius, m.d., latest
Series 5, No. 5 Bryant, m.d., latest

• SURFACE GRINDERS
Hanchett Horizontal Spindle Plano Type, model OS, m.d., latest
No. 7B Van Norman Automatic Piston Turning & Grinding Machine, m.d.
No. 11 Blanchard Rotary, m.d., latest
No. 25A-18" Heald Rotary, m.d., latest
No. 25A-24" Heald Rotary, m.d., latest
10x12x60" Norton Hydraulic Surface, m.d., latest

• THREAD GRINDERS
No. 33 Excello Precision, m.d., latest
No. 59A Excello Internal Thread, m.d., latest

• TOOL & CUTTER GRINDERS
No. 2 Cincinnati Universal, m.d., latest
No. 2 Norton Universal Hydraulic, m.d., latest
No. 13 Brown & Sharpe, m.d., latest

• MANUFACTURING LATHES
No. 4 LeBlond Boring Lathe, 37" bed, 13" hole
No. 9 12 LeBlond Multi-Cut, m.d.
8x132" LeBlond, m.d., latest
11x18" LeBlond Rapid Production, m.d.
13"x24" LeBlond Rapid Production, Timken, latest
13"x36" LeBlond Rapid Production, Timken, latest
Niles-Bement-Pond Quartering Machine, m.d., new

• ENGINE LATHES
10x20" centers Monarch EE Geared Head, m.d., latest
12x30" centers American Geared Head, m.d., late
14x30" Lodge & Shipley Selec. Head, m.d., latest
14"x54" centers Lodge & Shipley, m.d., latest
14"x102" centers LeBlond, m.d., 16 leg, latest
16"x10" Reed-Prentice, m.d., latest
16"x14' American Geared Head, m.d.
24"x12' American 12 speed Geared Head, taper
24"x12' Monarch Geared Head, m.d., taper
30" raised to swing 42"x21'6" American Geared Head, m.d., taper, Timken
32"x12' Lehmann Hydratrol Geared Head, m.d., taper, latest
36"x36'6" Niles Heavy Duty, m.d., latest, 2 carriages
50"x204" centers LeBlond Geared Head, m.d., taper, latest

• MANUFACTURING TYPE MILLING MACHINES
No. 00 Sundstrand Hydraulic Rigidmill, m.d., latest
No. 00 Cincinnati Model EA, m.d., latest
No. 12 Brown & Sharpe, m.d.
No. 1-12 Cincinnati, m.d., latest
No. 1-18 Cincinnati, m.d., latest
No. 2-18 Cincinnati, m.d., with rise & fall, latest
No. 2-24 Cincinnati, m.d., latest
No. 4-48 Cincinnati Plain Hydromatic, m.d., latest
No. 4-48 Cincinnati Duplex Hydromatic, m.d., latest
No. 34-36 Cincinnati Duplex Hydromatic, m.d., with tracer control, latest
No. 34-36 Cincinnati Plain Hydromatic, m.d., with tracer control, latest
No. 56-72 Cincinnati Duplex Hydromatic, m.d., latest
No. 56-90 Cincinnati Duplex Hydromatic, m.d., latest
Type P Ohio Mfg., m.d.
72"x6' Ingersoll Single Horizontal Spindle Traveling Housing Milling Machine, m.d.

• THREAD MILLING MACHINES
No. CT-36 Lees-Bradner, m.d., latest
No. CT-54 Lees-Bradner, m.d., latest
Hall Planetary, m.d.
10x24" Hanson Whitney, m.d., latest
10x48" Hanson Whitney, m.d.

• PLAIN MILLING MACHINES
No. 000 Brown & Sharpe, m.d., latest
No. 2B Brown & Sharpe, m.d., latest
No. 2 Cincinnati H.S. Dial, m.d., latest
No. 2HL Milwaukee, m.d., latest
No. 2MH Cincinnati, m.d., latest
No. 3B Brown & Sharpe, m.d., late
No. 3, 4 Kempsmith Maxi-Miller, m.d.

• UNIVERSAL MILLING MACHINES
No. 2 Cincinnati Medium Speed Dial, m.d., latest

• VERTICAL MILLING MACHINES
No. 00 Cincinnati, m.d., latest
No. 2, 3, 4 Cincinnati High Speed Dial, m.d., latest
No. 2, 3 Cincinnati Medium Speed Dial, m.d., latest
No. 2H, 4H Milwaukee, m.d., latest
No. 2HL Milwaukee Swiveling Head, m.d., latest
No. 2K, 3K, 4K Milwaukee Dial, m.d., latest
No. 5 Reed-Prentice, m.d., latest
Cincinnati Hydromatic, m.d., 2 spindles

• TAPERS
Baush Radial Drilling & Tapping Machine, m.d., latest
No. 1 Bakewell Precision, m.d.
No. 1R Bakewell Precision Radial Tapper, m.d., latest
No. 2 Bakewell Precision, m.d.

• SHAPERS
18" Invicta Shaper, m.d. thru gear box, new
24" Invicta Shaper, m.d. thru gear box, new
48" stroke Heavy Duty Morton H.D. Traveling Head Draw-Cut Shaper, m.d., with d.c. variable voltage equipment, 12" bed, latest type

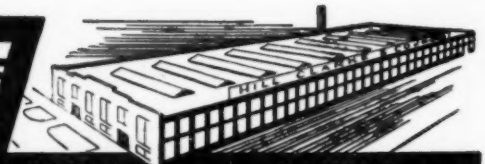
• MISCELLANEOUS
No. 12E Gisholt Static Balancing Machine, m.d., latest
No. 2A Pratt & Whitney Jig Borer, m.d.
90" Ohio Extra Heavy Worm Feed Revolving Table, m.d.
40" Tolhurst Chip Wringer, m.d.
No. 12M Morey, 2 spindle Profiler, m.d., latest
Gogan Hardness Tester, Model 1618
Logan Hydraulic Vertical Shaver, m.d.
Despatch Draw Furnace, max. operating tempwature 1250° F.

• TURRET LATHES AND SCREW MACHINES
No. 1H0 Libby, m.d., chucking, latest
No. 1A Warner & Swasey Universal, chucking, preselector head, latest
No. 2A, 3A Warner & Swasey Universal, chucking, Timken
No. 2F Gisholt Fastermatic, m.d., latest type
No. 2G Morey, bar, m.d., latest
No. 2L Gisholt, m.d., bar and chucking, latest
No. 3 Warner & Swasey Universal, m.d., bar, latest
No. 3 Warner & Swasey Universal, m.d., chucking, latest
No. 3A Warner & Swasey Universal, m.d., chucking, latest
No. 4 Warner & Swasey Universal, m.d., bar, preselector head, latest
No. 4 Warner & Swasey Universal, chucking, as above
No. 4A Warner & Swasey Universal, m.d., chucking, latest type
No. 4 FU Foster Fastermatic, m.d., latest
No. 5.0 Asmo Universal, m.d., designed for glass bottle work, latest
No. 5 Bardons & Oliver Universal Ram Type, m.d., chucking, pre-selector head, latest
6.2 Denver Turret Lathe, m.d. In log
No. 7 Bardons & Oliver Universal, m.d., chucking, late
2½" Jones & Lamson Universal Saddle Type, m.d., bar, latest

We carry an average stock of 2,000 machines in our 11 acre plant at Cincinnati. Let us quote on your requirements.

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio — MElrose 1241
CABLE ADDRESS EMCO

HILL-CLARKE MACHINERY COMPANY



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AUTOMATICS

1⅛" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1¼" (1942)
No. 6 Brown & Sharpe, M.D.
No. 49 New Britain, 4 Spdl. Chucker
Model A 2½" Cleveland (1943)
Model A 3¾" Cleveland (1942)

DRILLS

No. 150 Baker, tapping (1942)
No. D8 Colburn, No. 6 Morse Taper
No. 2 Fosdick 4 Spdl. (1942)
No. 2 Fosdick 8 Spdl. (1942)
No. 1-LMS Leland-Gifford's (1942)
No. 2-LMS Leland-Gifford's (1942)
No. 4BL Natco 36 Spdl. (1943)
5' Western Heavy (1942)
6'-17" Col. Fosdick Economax Radial

GEAR MACHINES

No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 18H Gould & Eberhardt
72" Cincinnati Gear Cutter

BORING MACHINES

3" Bar Universal Tri-way (1946)
No. 31 Lucas, 3" bar, M.D.
No. 46-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
36" Bullard Hi-speed (1942)
42" Colburn, M.D.
60" Colburn, M.D.
72" Niles Extra Heavy
84" Bolte M.D.

GRINDERS

3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
Norton Motorized Grinders ranging from 6"x18" to 24"x240"
12"x48" Cincinnati Univ. (1947)
72A-3 Heald Internal Grinder (1942)
72A-5 Heald Internal Grinder (1942)
74 Heald Internal Gdr. (1942)
Bryant Internal Grinders (1942)
Model HRF Barber-Colman Hob & Reamer Sharpener (1942)

LATHES

14"x30" centers Pratt & Whitney, Model C
16"-18"x30" P. & W. Model C (1947)
16"x54" centers LeBlond (1941)
16"x60" centers Pratt & Whitney, Model B
18"x6' American, Gdr. Head, M.D.
19"—38" gap x 10' LeBlond
36"—48"x16' Lehman Hydratrol (1945)
8"x15" Sundstrand, Model D (1943)
10" Sundstrands (1942, 1943)
16" & 20" Fay Automatics (1942)
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby, Bar Feed (1942)
No. H-5 Libby
No. 5 Bardons & Oliver (1942)
No. 5 Midland, Bar Feed (1942)
No. 1-H Libby, 6¼" Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

MILLING MACHINES

No. 2 SP Van Norman Plain (1942)
No. 2H Milwaukee Plain (1942)
No. 2 H Milwaukee Vertical (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3-V Van Norman Vert. (1942)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cin. Mig. (1940)
No. 2—18 Cincinnati, Rise & Fall (1941)
No. 2—18" Sundstrand-Electromil (1942)
38"x40"x10' Fitchburg Duplex Miller (1943)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex (1943)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 58-72 Cincinnati Hydromatic
4½"x12" Pratt & Whitney, Model C Thread Mill
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1942)
24"x24"x12' Ingersoll Adj. Rail Slab Miller
36"x36"x16' Ingersoll Slab Miller, 4 Hds.
No. 10 Ingersoll 72"x6' Travelling Col. Face Millers (1942)

MISCELLANEOUS

18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners

PLANERS

36"x36"x12' Cincinnati
36"x36"x18' Gray, Maxi Service, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

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UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 5—26" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 10"x30" Surface 12"x63", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x6', 8', 10'—10"x6', 8', 10'—18"x6', 8', 10'—20"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head motorized.
Large stock 19" and 18" bench and floor type.

Planers—Single head 24"x6', 24"x8', 26"x8'.

Shapers—16", 20", 24" B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled, ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' led wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

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ALL PRICES DRASTICALLY REDUCED!!

All Late Type

Bullard Multaumatics, 16", 12", 8" late
#42 Lucas Boring Mill 4" bar, '42 new
#28/60 Vertical Cincinnati Hydrotel, '44
2300 ton Bliss Hydraulic Press, sacrifice, late!
#2, #3 Cinci. Dial type, Univ. Mills
6'17" Column American Hole Wizard Radial Drill, AC Motor on Arm
5" Fisher Horiz. Floor Type Boring Mill, Late
5" Bar Table type boring mill, Giddings & Lewis #350T
#12 Brown & Sharpe Production Mills, 48½" x12" table size, $2250.00 ea.
#18 Blanchard Surf. Grinders 36" chuck, late type.
9/16", 1", 1¼", 1⅝", 2⅛", 2½" RA6 Acme Gridley Auto.

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All sizes spot welders, air & foot operated 25% off list price.
Hand Brakes all sizes up to 10'

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National Bent Shank Nut Tappers Battery of ⅝" to 1" Machines.
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Fisher 5" Bar, Floor Type Boring Mill. New in 1942.
Niles, Bement, Pond 60"x60"x24' table 4-Head Planer, Rev. D.C. M.D.
Bliss Presses in all sizes up to 1,000 ton capacity.
Wire Working Machinery.

National Machinery Exchange
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CRANK SHAFT HARDENING

200 KW.—3000 Cycle Induction Eqpt. complete 4 machine vertical setup to handle 6 cyl. shafts.

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INDUSTRIAL CHILLING MACHINE
DEEP FREEZE CASCADE 120° F. Height 38" Length 82", Width 32¼", Approximately 7½ cubic feet. WITH 2 MOTORS, ½ and ¾ HP. 3/60/220.
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Rotary Vibrating Riveter
One number 4A Grant Rotary Vibrating Riveter, two HP motor. Practically new condition. Some extras.

UNIVERSAL GRINDER
One number 2 Cincinnati

MEMPHIS CASTING WORKS INC.
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LATEST TYPE *Nearly New* MACHINES

BORING MILLS—Horizontal
CINCINNATI GILBERT 3½" bar, floor type, latest
DETRICK & HARVEY 4" bar, Floor Type, M.D.
GIDDINGS & LEWIS #20T, 2½" bar, Latest Type
HEALD 48, 49 single end, Boromatic, Latest
GIDDINGS & LEWIS #45, 5" bar, Latest Type
LANDIS—#35—3½" bar, floor type, M.D.
LUCAS #41, 3" bar, Table Type, Latest Type
LUCAS #43, 5" bar, Table Type, Late Type
NILES BEMENT-POND 5", 8" bar, Floor Type, M.D.
UNIVERSAL 3" bar, high speed, latest type

BORING MILLS—Vertical
BULLARD 16" 6-spindle Mult-Au-Matic Type D, Latest
BULLARD 12" 6-spindle Mult-Au-Matic Type D, Latest
BULLARD 24", 30" Turret "New Era" Side Head, M.D.
BULLARD 24", 30", 42" Vert. Turret "Spiral Drive" High Speed, Latest Type
COLBURN 72", 2 swivel heads, PRT, M.D.
KING 62", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, Rapid Traverse, AC M.D.

BRAKES—Power
CINCINNATI Series 200, ½"x8'6", M.D.
VERSON #200, 10 gauge x 90", Latest Type

BROACHES
AMERICAN V-2, 6 ton Hyd., Latest Type
CINCINNATI 1-30, 3-30, Duplex Vertical Surface, Hyd., Double Ram, Model ER, Latest Type
LaPOINTE 5-36 Vertical, Hyd., Latest Type

DRILLS—Miscellaneous
BARNES H-3 "Hydram," Hydraulic, 3" capacity—for inverted drilling, Latest Type
CINCINNATI BICKFORD 24" Box Column, Latest
LELAND & GIFFORD #1LMS, 4 Spindle, Latest Type
LELAND & GIFFORD #2, #2MS, Single Spdle.
LELAND & GIFFORD #2LMS 3 and 6 spindle, Latest

DRILLS—Deep Hole
BARNES 420/2 Spindle Hydraulic, Latest Type
LeBLOND #2 Single Spindle, Hydraulic, Latest Type
PRATT & WHITNEY #1Bx36", Hyd., Latest Type

DRILLS—Multiple Spindle
BOLEY 10 spdles, ⅝" cap, High Speed, Latest
NATCO G-5, Adjustable, Hyd., Latest
NATCO #1AL, 30 Spindles, Hyd., Latest Type

DRILLS—Radial
AMERICAN 4' arm 11" col. "Hole Wizard," Latest
AMERICAN 4' plain Triple Purpose, Motor Drive
AMERICAN 5' arm 13" column Plain, M.D.
CINCINNATI BICKFORD 5'10" Column, Plain, M.D.
CIN. BICKFORD 6' arm 15 col. Plain or Univ., M.D.
DRESES 5' arm 15" column Univ., M.D.
WESTERN 6' arm 20" column Plain, Latest Type

GEAR CUTTING EQUIPMENT
BARBER COLMAN #12 Hobber, Single and Double Overarm, Motor Drive
BROWN & SHARPE 6-60 Gear Cutter, Motor Drive
BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
BROWN & SHARPE #50 Universal Gear Chamferer, Latest Type
CROSS #250 Universal Gear Chamferer, Latest Type
FELLOWS 6I, 6IA, 6SA, 6ZZ, Model Z, 7A, 7, 72, 72S, 77 High Speed Gear Shaper, Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #13LS Lapper, latest type
FELLOWS 8M Red Liner, Latest Type
GLEASON #14 Hypoid Spiral Generator, Latest Type
GLEASON 5", 12" straight bevel generator, latest type
GLEASON #4, #6, #18 Bevel and Hypoid Tester
GOULD & EBERHARDT 12H Hobber, Latest Type
GOULD & EBERHARDT 96H Hobber, with diff. M.D.
PRATT & WHITNEY 16" Grinder, hyd., latest

GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
BROWN & SHARPE #9 Plain Hyd., Latest Type
LANDIS 6x12, Type B Plain, Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd., Latest Type
NORTON 6"x18", 6"x30", 14"x36", 10"x72" Type C, Plain, Latest Type

GRINDERS—Miscellaneous
BARBER COLMAN #3, #4 Hob Sharpener, Latest
BROWN & SHARPE No. 13 Univ. Cutter & Tool, Lat.
BRYANT 16-CP-18, #24—36", Internal, Hyd., Latest
CINCINNATI #2, #4, Centerless "Filmatic", Latest
CINCINNATI "Monoset" Tool & Cutter, Latest
GARDNER 24-5/8" Disc Grinder, Latest
FITCHBURG 14"x25" Spline, hydraulic, latest

GLEASON #12 tool sharpener, Latest Type
HEALD 72A3, 72A5 "Gagematic," Internal, Latest
HEALD 75A, 72A3, 72A5, 74, 76A Internal, latest
HEALD & LAMSON 6x15, 8x18 Auto Thread, latest
JONES & LAMSON 6x15, 8x18 Auto Thread, latest
LANDIS #6, 6x24 Thread, latest type
LANDIS #12 Centerless, Hydraulic, Latest Type
THOMPSON 6"x48" Auto., round broach, M.D.

GRINDERS—Surface
BLANCHARD #11, 16" diameter magnetic chuck, Latest
BLANCHARD 18A Vertical, Dial Feed, Motor Drive
BLANCHARD #22, 9"x26", Hyd., Latest Type
DO-ALL Model G-7, 9"x26", Hyd., Latest Type
HANCHETT Series 300 12"x18" Vert. Hyd., Latest
HANCHETT #36, Vert., 36" dia. mag. chuck, Latest
HANCHETT #120, 30x120" Plano, Hyd., Horiz., Latest
HEALD #22 Rotary, 12" chuck, latest type
HEALD 25A—rotary—10" and 36" chuck, Hyd., Latest
NORTON 6x18 Hydraulic, latest type
THOMPSON 12x12x24 Type D Hyd., Latest Type

JIG BORERS
KEARNEY & TRECKER Model B, Autometric, Latest
PRATT & WHITNEY 1A, Motor Drive

LATHES—Engine and Mfg.
AMERICAN 36"x360" centers, 2 carriages, motor drive
BRIDGEFORD 36"x32" bed—2 carriages, M.D.
HENDEY 12"x30", 14"x30", Timken, latest Type
JONES & LAMSON "Fay" 20x25", 24x24 autom., latest
JONES & LAMSON "Super-Hegel", Latest
LeBLOND 21"x60" Centers, "Super-Hegel", Latest
LeBLOND 21"x60" Centers, Geared, Motor Drive
LEHMANN 16x30" centers, TIMKEN, latest type
LODGE & SHIPLEY 16"x30", 14"x30" Timken, Latest
LODGE & SHIPLEY 18x72 centers, M.D.
LOSWING 4x60, 4x84, 8x60, 8x108, 5x24, Latest
MONARCH 10"x30" centers, Model EE, Timken, latest
MONARCH 12"x30" Centers, Model CKS, Timken, lat.
MONARCH 12"x24" Centers Model CW, Latest
MONARCH 16"x78" Centers, Model CW, Latest Timken
MONARCH 22"x456" Centers, 3 Carriages, Timken Bearing, Model CM, Motor Drive
MONARCH 24"x24" Ball Bearing, Geared Head, M.D.
NILES 20"x50" Boring "Time Saver" Timken, Latest
PRATT & WHITNEY 16"x30" Centers, Timken, Latest
PRATT & WHITNEY 10"x24" centers, Bench, latest
PUTNAM 42"x25' Centers, Motor Drive
REED PRENTICE 20"x54" Centers, Model A, Latest
SPRINGFIELD 16"x30" centers, Timken, latest type
WARD, HAGGAS & SMITH—18/30x60" centers gap, motor drive, Latest Type

LATHES—Hob and Cutter Relieving
MICHIGAN 1708 Universal, Latest Type
MICHIGAN 1712 Universal, Latest Type
U. S. TOOL #810B, Latest Type

LATHES—Turret
BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #4FU "Fastermatic," Timken, Latest
GISHOLT #1L, #2L, #3L Universal, Timken, Latest
GISHOLT #2, #4, with TIMKEN, Latest Type
GISHOLT #2, #4, with TIMKEN, Latest Type
JONES & LAMSON #3, #5, Univ., Timken, Latest
LIBBY "International" 1HS Univ., Timken, latest
MOREY No. 20, No. 3, No. 4, Timken Bearing, latest
POTTER & JOHNSTON #3D2E, Timken, Latest
WARNER & SWASEY 5, Universal, Timken Bearing
WARNER & SWASEY #2, #3, Timken, Latest Type
WARNER & SWASEY 1A Univ., Timken, M.D.
WARNER & SWASEY 2A Universal, Timken Bear
WARNER & SWASEY 3A Universal, Timken Bearing, "Pre-selector," Bar and Chucking, Latest Type
WARNER & SWASEY 3A Universal, Timken Bearing, Bar and Chucking, Latest Type
WARNER & SWASEY 4A Universal, Timken Bearing, Bar and Chucking, New 1947

MILLING MACHINES—Mfg.
HALL Style L, Planetary, latest type
INGERSOLL 42"x36"x12" adj. rail, 4 heads, AC, M.D.
INGERSOLL 32x24x16" adj. rail Type, 2 heads, AC, M.D.
INGERSOLL 30x24x12" adj. rail slab, M.D.
SUNDSTRAND Model 3A Duplex 42" feed, Latest
TAYLOR & FENN M80 Duplex Spline, latest

MILLING MACHINES—Plain
BROWN & SHARPE #2, Light Type, Timken, Latest
BROWN & SHARPE #12, 24" feed, Timken, Latest Type
BROWN & SHARPE #00, Timken, Latest Type
BROWN & SHARPE #2B, 3B, Timken, Latest Type
BROWN & SHARPE #2B, 3B, Timken, Latest Type
CINCINNATI 08 Automatic Rise & Fall, Latest Type
CINCINNATI 1-12, 2-18 Automatic, Latest Type
CINCINNATI #2, #3, #5, High Power, Latest Type
CINCINNATI 4-36 Hydromatic, Simplex, Latest Type
KEARNEY & TRECKER #2B, 3B, 4B, 5H, Latest
KEARNEY & TRECKER 1104 Simplex, Latest
KEARNEY & TRECKER 1218 Simoplex, Latest
KEARNEY & TRECKER #3, 4, Heavy, Timken, M.D.
KEARNEY & TRECKER 4K, Timken Bearing, Late
KEARNEY & TRECKER 4K, Timken, Latest
KEMPSMITH #4 Manl-miller, Timken, Latest
KEMPSMITH #36, Timken, Latest Type

MILLING MACHINES—Thread
LEES BRADNER 12"x14" Centers, Latest Type
MOREY 12x36" 60° 120°, 120° centers, Latest
PRATT & WHITNEY 6"x60" centers, Model C, Latest

MILLING MACHINES—Universal
BROWN & SHARPE No. 2A, Timken Bearing, Latest
BROWN & SHARPE No. 3A, 4A, M.D.
KEARNEY & TRECKER #2 Heavy, Timken, M.D.
KEARNEY & TRECKER 2H, Timken, Latest Type
KEARNEY & TRECKER 3H, Timken, latest type
KEMPSMITH #4 Maxi-miller, Timken, Latest Type
VAN NORMAN #3 duplex, Motor Drive
VAN NORMAN #12, #20, #36, Timken, Latest Type

MILLING MACHINES—Vertical
BROWN & SHARPE #2 Standard Timken, Latest
CINCINNATI #2, #4 Dial Type, Timken, Latest
CINCINNATI #98, TIMKEN, Latest Type
CLEVELAND #1 High Speed, Latest Type
GORTON 8D, 8½D, Super-Speed, Latest Type
KEARNEY & TRECKER 2K, 3H, Timken, Latest Type
MOREY 12M Single & Double Spindle Profiler, Latest
REED PRENTICE 3VG, with or without hydraulic duplicator, Timken bearing, Latest Type

PLANERS
BETTS (CONSOLIDATED) 81"x92"x16' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
BETTS (CONSOLIDATED) 108"x84"x16' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
CINCINNATI 30"x30"x8', 4 heads, PRT, DC M.D.
DETRICK & HARVEY 48"x48"x16' 4 heads, Hydraulic, Rapid Traverse, A.C. Motor Drive
NILES 108"x81"x22' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
NILES 42"x12"x14' "Time Saver," Box Table, 3 Heads, PRT, VARI VOLTAGE Drive, Latest

NILES 48"x18"x11', 4 Heads, PRT, Box Table, DC, M.D.

PRESSES
BIRDSBORO 325 ton, vert. hyd., Latest Type
BLISS 75-55 Hydro-Dynamic, Double Action, Latest
GLEASON 15" Quenching, Hyd., Motor Drive
HANNIFIN 15 ton molding, Latest Type
HENRY & WRIGHT 50 ton Dieing, Roll Feeds, M.D.
LAKE ERIE 500 ton Vert., Hyd., Latest Type
LUCAS 30 ton Forcing, Latest
NILES 400 ton, Horiz. wheel, Motor Drive
UNITED ENG. 500 ton, Vert., Hyd., Latest

SCREW MACHINES—Automatic
CLEVELAND 3/16", 1 1/16" Model A, Latest Type
CONSOMATIC 2¾"—6 spindle, Latest Type
GOSS & DeLEEUW 6"x6¾", 5 spindle Chucker, Tool rotating, Latest Type
GOSS & DeLEEUW 5" 5 spindle Chucker, Work Rotating, Latest Type

SHAPERS & SLOTTERS
AMERICAN 20" Heavy Duty, Motor Drive
DILL 20"-24" Vertical, Motor Drive
GOULD & EBERHARD #0, 22", High Duty, M.D.
PRATT & WHITNEY 6" Vertical, M.D.
SMITH & MILLS 16" high speed, latest type

SHEARS—Power
WYSONG & MILES #572, 14 gauge x 6', Latest Type
QUICKWORK #5, ¾" Cap., Rotary Shear, M.D.
QUICKWORK #6, 1" Cap., Rotary Shear, M.D.

MISCELLANEOUS
AJAX 2", 2½" Forging and Upsetting, M.D.
BAKER #3 Keyseater Motor Drive
BANES #172, 306H, 307, 307H Vertical Hone, Hyd., Self-Oiling, Latest Type
CAMPBELL #401 Abrasive Saw, Latest Type
DE LAVAL #194 Coolant Clarifier, Latest
LANDIS 2" Single and Double Spdle. Bolt Threader, M.D.
MANVILLE 20 7/16" Cap. SSSD, Ball Header, M.D.
NAZEL #4H Pneumatic Hammer, M.D.
NORTON #2F 10U Vertical Lapper, Latest Type
PRATT & WHITNEY (KELLER) Type BL 2416, Type G, Carving, 2 and 3 dimensional, Latest Type
PRATT & WHITNEY ⅛B 50 Rifler, Latest Type
ROWBOTTOM Cam Miller, Motor Drive

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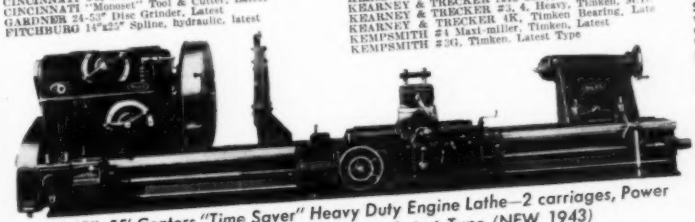

NILES 60"x55' Centers "Time Saver" Heavy Duty Engine Lathe—2 carriages, Power Rapid Traverse with each carriage, Latest Type (NEW 1943)

Most Built After 1941

Available for Prompt Shipment

(Partial List) Over 2,000 Machine Tools in Stock. Your Inquiries Are Invited . . . Prompt Service Is Assured

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CABLE ADDRESS: WOODWORK, N. Y.

UNUSUAL BUYS WITH GUARANTEED PERFORMANCE

AUTOMATICS

National Acme Model "C" 9/16", 5 spindle
Conomatic 4 spindle, 4¾"
Acme Gridley RA-1, 6 spindle
Cleveland Model "A" 9/16"
New Britain Gridley 2¼", Model Gi, 6 spindle

BORING MILLS

Bullard 24" Vert., Spiral Drive
Bullard 30" Vert., New Era Type Head
Bullard Mult-Mill 54", 2 hds. on rail, Vert.
Lucas 3" bar, 21. Horiz.
Cincinnati Gilbert 3½" spindle, Latest Type
Heald #49, Single End Borematic
Heald #67 A, Boring Machine
P & H Horiz., 4" bar
Defiance #25 A Boring—Drilling, 3¾" bar
Defiance #6, 4½" bar

LATHES

American 14"x6', 3 sed, SCEL
American 16"x78" Pacemaker, 27 speeds, MD
American 16"x8', 4 sed, bg, SCEL
American 16"x6', Collman Drive
American 16"x8', 3 sed, dbg, SCEL
American 18"x8', Geared Head
American 18"x10', 3 sed, Bowl Head, BG
American 24"x10', SPD, GH, SCEL
American 24"x12', 8 speed, GH, SCEL
American 24"x14', 8 speed, GH

AMERICAN 30"x15' GH, 12 SPEED, SCEL, M.D.
AMERICAN 30"x26' GH, 12 SPEED, SCEL, M.D.
AMERICAN 42"x14' BED INTERNAL FACE PLATE DRIVE GH ENGINE LATHE, M.D.

Boye & Emmes 18"x6', 4 sed, dbg, SCFL
Boye & Emmes 18"x6', 3 sed, dbg, SC, L
Boye & Emmes 18"x8', 3 sed, Lima Drive
Boye & Emmes 18"x10', M.D., SCEL
Hendy 14"x6', 3 sed, qc, SCEL
Hendy 14"x6', 4 sed, Drive all Drive
Hendy 14"x8', Model EBM, Motor driven
Hendy 16"x6', 4 sed, sbe, SCEL
Hendy 18"x8', 4 sed, SCEL
LeBlond 17"x8', spd, 12 speeds, gh
LeBlond 17"x8', 3 sed, dbg
LeBlond 21"x8', 3 sed, dbg, SCEL
LeBlond 24"x10', 3 sed, SCEL

LEBLOND 25"x12' H.D., QC, SCEL, M.D.

LODGE & SHIPLEY 14"x30" CENTERS, SELECTIVE G.H., M.D.

Lodge & Shipley 14"x5', 5 sed, bg, SCEL
Lodge & Shipley 14"x6', 3 sed, dbg, SCEL
Lodge & Shipley 16"x8', Selective G.H.
Lodge & Shipley 18"x8', spd, SCEL
Lodge & Shipley 18"x8', 3 sed, dbg, SCEL
Lodge & Shipley 18"x9', 3 sed, dbg, SCEL

LODGE & SHIPLEY 20"x8' GH, SCEL, M.D.

Lodge & Shipley 20"x10', 5 sed, SCEL
Lodge & Shipley 24"x10', 3 sed, dbg, Turner Uni Drive
Monarch 14"x8', 3 sed, dbg
Monarch 16"x8', 8 speeds, SCEL

NILES TIMESAVER 30"x10' CENTERS, DOUBLE WALL APRON

Sebastian 16"x8', 4 sed, SCEL
Sebastian 20"x8', GH, SCEL
Schumacher & Boye 36"x24', Internal Face Plate Drive
Springfield 18"x8', 4 sed, SCEL

GEAR CUTTERS

Brown & Sharpe #3—36" Automatic, SPD
Gould & Eberhardt 18H, spd, MD
Gould & Eberhardt 36S, Vert. cutter
Brown & Sharpe #3—20", MD
Fellows #615, Helical
Gleason 6" straight Bevel, MD
Gleason 12" Spiral bevel gear Generator

GRINDERS, ALL TYPES

Cincinnati #2 Centerless
Cincinnati #3 Centerless
Brown & Sharpe #13 Univ. & Tool Grinder
Covel #91A Univ. Cutter & Tool Grinder
Gardner #120A Opposed Wheel Grinding Machine
Sellers #4T Tool Grinder
Landis 4"x12" Type H Plain Cylindrical Grinder
Landis 12"x72" Plain Self Contained Grinder
Norton 14"x96" Type BA Plain Grinder
Landis 20"x220" centers, Plain Cylindrical Grinder
Landis 18"x72", Plain Self Contained
Brown & Sharpe #12 Plain Grinder
Norton 14"x36" Univ. Grinder
Landis 10"x24" Type "C" Hyd. Univ. Grinder

GRINDERS

ExCello #35L Precision Thread Grinder
Gallmeyer & Livingston #4, Univ. Tool Grinder

TURRET LATHES

WARNER & SWASEY #5, WITH PRESELECTOR

Warner & Swasey #2, Ram type

GUARANTEED MACHINERY

Cincinnati Machinery Co., Inc.
219 East Second Street
Cincinnati 2, Ohio

BRAKES—(Press), Cinci. 10'x¾" (1935)
Geo. Ohl 10½'x⅝"
HAMMERS—Board Drop, Bliss, 300 lbs.
AUTOMATICS—(2) Natl. Acme 1⅝", four spindle, Bargain.
HYDROHONER—Micromatic, Model #4H (1943)
PLATE EDGE PLANER—H. & J. 32'x2"
MILLER—Plain K. & T. #4K, Late
PLANER—N.B.P., 48"x48"x26'; 4 Heads
PRESSES—Z. & H. #7, 50 ton, Percussion
Bliss #6, 125 ton, Late
Clearing, 200 ton (1943)
Bliss #310, 450 ton

Lake Erie, 750 ton, Hydraulic, Bed 72"x146", single or double Action, late (will draw 22")

ROLLS—Bending, 30'x¾" Pyramid
12'x¾" Pyramid
11'x¾" Initial

KINGS COUNTY MACHINERY EXCHANGE
408 Atlantic Ave., Brooklyn 17, N. Y.
Dept. "A" Phone: TRiangle 5-5237

HEAVY SQUARING SHEARS — FOR SALE

2 Birdsboro 156"x½" Power Gap Shears, 15" Gap, Back Geared, w/extra blades.
PRICE .....$6,000.00 EA.

2 Hyde Park 156"x½" Power Gap Shears, 18" Back Geared, w/extra blades.
PRICE .....$4,750.00 EA.

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IN STOCK FOR IMMEDIATE SHIPMENT

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FIFIELD LATHE

61" sw., 72" cen., qc, $3800. Pond planer, 36" by 36" by 8', 4 heads, $1600. Both machines motorized.

MITCHELL MACHINE

48 E. Warren Detroit 1, Mich

CHECK THIS LIST OF FINE TOOLS

AUTOMATICS

½"x2" No. 0G Brown & Sharpe automatic.
8" Bullard Multramatic, 6 station, single index.
⅝" National Acme Gridley Model R-6 6 spindle.
⅞" Cone 4 spindle.
1¼" Cone 4 spindle.
1⅛" Cleveland Model M, 4 spindle.
1⅝" No. 61 New Britain Gridley 6 spindle.
1¾" Greenlee 6 spindle.
1⅞" Conomatic 8 spindle.
2"x18" Cleveland Model B.
2⅝" Acme Gridley Model RA6, 6 spindle.
No. 454 New Britain 4 spindle chucking.
14"x18" Monarch Mag-Na-Matic lathes.
14"x18" Fay, front and rear tool slides.
6" Sundstrand automatic stub lathe.
1" Economy type S automatic shaver, hopper feed.
No. 18 New Britain 6 spindle chucker with set of 9" two jaw chucks.

BROACHES

2 Ton American Model HO horizontal hydraulic.
No. 2-48 Cincinnati duplex vertical surface breach.
No. 1 Foote Burt double ram vertical surface.
No. 3 Type XA Oilgear hydraulic.
No. 3 Lapointe screw type.
American V48 vertical pull broach.
Model HAS 10-72 Colonial 10 ton 72".
10"x72" Colonial broach sharpener.

DRILLS UPRIGHT AND HEAVY DUTY

20", No. 2 Colburn single spindle box column
20" W. F. & J. Barnes box column.
20" Cincinnati Super-Service production.
20" Harmond type BA.
20" Sibley.
21" Canedy Otto New.
21" Cincinnati Bickford box column Mfg.
21" Barnes 4 spindle No. 210
22", No. 121 Baker box column heavy duty.
24" Cincinnati Bickford.
24" Cincinnati Bickford box column Mfg.
24" Kokomo.
24" No. 217 Baker 3 spindle, box column heavy duty.
24" No. 310 Baker heavy duty manufacturing.
24" No. 315 Baker box column heavy duty.
24" No. 25 Foote Burt heavy duty.
28" Aurora.
36" No. 513 Baker heavy pattern high speed.
No. 30 HO Baker hydraulic feed, 2 spindle, inverted type.

DRILLS, MULTIPLE

Baush horizontal two way multiple.
42 Spindle No. B18 Natco, 18"x48" drilling area.
34 Spindle No. 30 Natco, 22"x28" drilling area.
No. 84A Natco multiple drill or Holetapper.
22 Spindle No. 14 Natco, 18"x24" drilling area.
22 Spindle No. 15 Natco, 18"x24" drilling area.
18 Spindle No. 2 BL Natco hydraulic feed.
12 Spindle No. 39 Natco rail type.
No. 11 Natco 11" diameter round head.
12 Spindle No. 25 Baush hydraulic feed rail drill.

BORING MILLS, HORIZONTAL AND VERTICAL

2½" No. 25T Giddings & Lewis.
3" No. 3A Universal.
3½" No. 32 Lucas table type.
3½" No. 5A Defiance table type.
5" barr Jones planer table type.
100" Niles Bement Pond. Extra Heavy Pattern vertical.
52" King vertical.

SHAPERS

28" Gould & Eberhardt, "Invincible" type.
24" Gould & Eberhardt.
24" Columbia Heavy Duty with universal rotatable table.
20" & 24" Gemco universal. NEW.
20" Gould & Eberhardt.
20" Gould & Eberhardt high duty.
Two 8" Pratt & Whitney vertical.

THREADERS

No. 11 Murchey ¼" to 1½" long bed pipe or bolt.
2" Landis pipe threader.
2" Hill Acme.

MILES MACHINERY CO.
SAGINAW, MICH.

may improve a used machine's appearance

but

You cannot get production from the exterior finish of a machine tool

● In selecting a used machine for your shop you should have confidence in the concern with whom you are doing business, in their ability to appraise the value of a used machine and—in their facilities for rehabilitating used equipment. Motch and Merryweather know machine tools—they build them—they represent some 36 manufacturers—and they have had years of experience in rebuilding machines. You can count on dependable service from any machine bearing the Motch and Merryweather name plate.

BORING MACHINES
#330-T Giddings & Lewis Horizontal Boring Mill
#41 Lucas Horizontal Boring Mill
#50 Giddings & Lewis Horizontal Boring Mill
14" Niles Tool Works Boring Mill
36" Bullard Vertical Turret Lathe, New Era
36" Bullard Vertical Turret Lathe, Spiral Drive
42" Bullard Vertical Turret Lathe, New Era
42" King Vertical Turret Lathe
#49 Heald Bore-Matic, Double End
#47-A Heald Bore-Matic, Single End
#46-B Heald Bore-Matic, Double End

DRILLS
#30-HO Baker Heavy Duty Drill
#2-BL Natco Multiple Spindle Drill
3½'"9" Column Cincinnati Bickford Radial Drill
4'12" Column American Motor On Arm Radial Drill
6'17" Column American Radial Drill
#2 Avey 4-Spindle Sensitive Drill, Aveymatic Feeds
#2 KH Allen 6-Spindle Sensitive Drill
#4 Fosdick Upright Drill

GRINDERS—CYLINDRICAL
#2 Cincinnati Centerless Grinder, "Filmatic Bearing"
#2 Cincinnati Centerless Grinder, Older Model
4"x12" Landis Plain Hydraulic Cylindrical Grinder
6"x18" Norton Type C Plain Cylindrical Grinder
10"x18" Cincinnati Model ER Cylindrical Grinder
10"x36" Cincinnati Model EA Cylindrical Grinder
16/20x72" Norton Type C Cylindrical Grinder

GRINDERS—INTERNAL
#5-A Bryant Hole and Face Grinder
#16-16 Bryant Internal Hydraulic Hole Grinder
#72-A Heald Plain Internal Grinder
#72A3 Heald Plain Internal Grinder, Cross Sliding Head
#72A5 Heald Extended Bridge Internal Grinder

GRINDERS—SURFACE
6"x18" Norton Vertical Spindle Surface Grinder, New Machine
#34 Abrasive Vertical Spindle Surface Grinder
#10 Blanchard Rotary Surface Grinder
#11 Blanchard Rotary Surface Grinder
#16 Blanchard Rotary Surface Grinder
#22 Heald Rotary Surface Grinder
#25-A Heald Rotary Surface Grinder

GRINDERS—UNIVERSAL
10"x24" Landis Type C Universal Grinder
#2 Brown & Sharpe Universal Cylindrical Grinder
#3 Brown & Sharpe Universal Cylindrical Grinder

GRINDERS—MISCELLANEOUS
#13 Brown & Sharpe Tool & Cutter Grinder
#7 Badger Double End Disc Grinder
#214 Besley Double End Disc Grinder

LATHES
14"x6' Hendey Geared Head Lathe
18"x48" Hendey Motorized Lathe
18"x72' Monarch Geared Head Lathe—Older Model
28"x30' Bridgeford Geared Head Lathe

MILLING MACHINES—MANUFACTURING AND PLAIN
#1-18 Cincinnati Manufacturing Type Mill
#1H18 Kearney & Trecker Manufacturing Mill
M24 Kearney & Trecker Manufacturing Mill
#2-HL Kearney & Trecker Plain Horizontal Mill
#2-L Cincinnati Plain Horizontal Mill
#3 Cincinnati Plain Horizontal Mill
#3 Van Norman Plain Horizontal Mill
#4 Cincinnati Dial Type Plain Horizontal Mill
#5 Cincinnati High Power Plain Horizontal Mill
30"x30"x14' Ingersoll Adjustable Rail Mill

MILLING MACHINES—VERTICAL
#8-D Gorton Vertical Mill
#2 Cincinnati High Speed Dial Type Vertical Mill
#2-H Kearney & Trecker Vertical Mill
#3-H Kearney & Trecker Vertical Mill
#3 Cincinnati Medium Speed Dial Type Vertical Mill
#40 Knight Vertical Mill
#4 Cincinnati High Power Vertical Mill
#4-H Kearney & Trecker Vertical Mill

PLANERS
48"x48"x12' Liberty Openside Planer
66"x48"x12' Cincinnati Double Housing Planer

SHAPERS
32" American Universal Shaper, Gear Box Drive
36" American Universal Shaper, Gear Box Drive

TURRET LATHES
#2 Warner & Swasey Plain Turret Lathe
#3 Warner & Swasey Universal Turret Lathe
#4 Warner & Swasey Ram Type Universal Turret Lathe, Pre-Selector
6-R Denver Acme Ram Type Universal Turret Lathe
#1-L Gisholt Universal Turret Lathe
#2 Cincinnati Acme Semi-Universal Way Type Turret Lathe

MISCELLANEOUS
#6 Fellows Gear Shaper, Spur Gears Only
#135 Cleveland Hobber
#2 BG Garvin Tapper (Late)
15 Ton Lucas Forcing Press
Type A Barber-Colman Gear Hobber

See **MOTCH** *and* **MERRYWEATHER** *first.*

MOTCH AND MERRYWEATHER MACHINERY CO
CLEVELAND DETROIT
CINCINNATI PITTSBURGH

USED MACHINE DIVISION
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This Column FOR SAVINGS

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Bridgeford 36"x56' Gr. Hd.—3 to 150-RPM—38" swing—48' C. Dist.—taper attchmt.

Lodge & Shipley 30"x16' Gr. Hd.—7 to 260-RPM—34½" swing—118" C. Dist.

Putnam Heavy Duty 36'x20'—triple bk. grd.—M.D.—37" swing—12'7" C. Dist.

American 16"x126" centers
Hi-Duty geared head. Taper Attach.

HORIZONTAL BORING MILLS

Yoder #3A 3" Bar (late type)

Universal 4" bar "Triway" (late)—added vert. range—8 to 300-RPM—taper #6 Morse

Defiance #25A, 3¾" bar (late) — added Vert. & Cross range—12 to 1000-RPM—taper #6 Morse

Lucas #33, 4½" bar—5 to 151-RPM—taper #6 Morse—A.C. motor drive

MILLERS

Milwaukee #5H Horizontal Hi-Speed.

VERTICAL MILLERS

Milw. (K&T) #2K & 3K Hi-Speed—15 to 1500

Reed-Prentice #4 "Improved" Hydraulic—30 to 1200-RPM—1945 Machine

TURRET LATHES (late type)

J & L #5 Univ. Ram Type—2½" cap.—21¼" swing—bar & chucking

J & L #7A and 8A, 12-speed Univ. Saddle Type—20-1000-RPM—21¼" swing—bar & chucking

GRINDERS

Farrel 30"x182" M.D. Roll Grinder—A.C. motor drive

Excello #35 Univ. Precision Thread—8"x22"—attchmts—(excellent condition)

Mattison 24"x18"x96" Hydraulic Hi-Power Precision—D. C. generator—chucks—coolant

This Is Only a Partial Listing.
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Botwinik Brothers of Mass. Inc.
3 SHERMAN ST. WORCESTER 1, MASS.

BOREMATICS, Heald 49 & Excello 215A
CHUCKERS, P&J 4D and 5D
GRINDER, Cincinnati #3 Centerless
GRINDER, Hanchett #36, 40" chuck
GRINDER, Blanchard #18, 36" chuck
GRINDER, Besly 218 Opposed Type
GRINDER, Cincinnati 6 x 30 Pl. Hd.
GRINDERS—THREAD, Excello #33
HONE, Barnes #224, Serial #1972
LATHE, Bullard 36" Vertical Turret
LATHES, Gisholt #12 Automatic
LATHES, W & S #2, #3, #4 Turret
LATHE, Sundstrand #8 Automatic
MILLER, Cincinnati #4-36 Hydromatic
MILLER, Cincinnati #3-24 Simplex
MULTAUMATIC, Bullard 18" Std. 8 Sp.
PLANER-MILLER, Ingersoll 56"x48"x14'
PRESS, Henry & Wright 50T Dieing
SCREW MACHINE, Acme Gridley 1" RA-4
SCREW MACHINE, Cone 1⅜" 8-Spin.

BRM MACHINERY CORP.
57-B Edison Place
Newark 2, New Jersey

CINCINNATI PLAIN CYL. and HEALD GAGEMATIC GRINDERS

1—10"x36" Cincinnati Plain Cyl. Grinder—Model ER—Ser. #3P2D1M
1—Spdl. reciprocating att. Stroke 1/32x3/16
1—Hand servo infeed att. hydraulically operated for hand plunge cut grinding. Includes rapid advance of wheel to work & auto. starting & stopping of coolant flow & work rotation.
1—15 HP, 1800 RPM Open Frame, sleeve brg. main drive motor for 440 V 3 PH 60C Current
1—Control for above motor, including a control transformer & 100 V coils
1—Hydraulic drive motor, 1½ HP
1—Control for above motor
1—Coolant Motor
1—Variable voltage headstock drive, consisting of one unit motor-generator exciter set with variable voltage control panel, rheostat & magnetic starter with push button station for AC driving motor
1—Headstock complete with motor: 1 HP 1150-2300 RPM frame TL-204, Ser. #987718, with belt guard and 3 belts.
1—#72A3 Heald Gagematic Grinder—Ser. #1334
1—Heald 5⅛" Chuck—34-93067 for same

Write or wire for additional information and prices.

VICTORY CARBIDE SAW & TOOL CO.
3850 N. Ashland Avenue, Chicago 13, Ill.

PRATT & WHITNEY

KELLER

1945 Machine — Bargain Price

Complete with motor—220-440/60, control cabinet—(3 dimensional) generating unit, 3 dimensional tracer,—1 each, profiler, automatic tracer, high speed spindle, Angle Plate complete. (Top and bottom section.) Machine can be inspected under power.

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7906 Mack, Detroit 14, Michigan
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SPECIAL OFFERING

New in 1948

18"x38" LEBLOND Heavy Duty Sliding Bed Gap Lathe—72" gap closed, 120" gap open, with chip pan, extension rest, taper attachment, face plate jaws, steady rest, 18" 4-jaw chuck. Today's replacement cost over $11,500.

Special sales price **$8600.00**

BARNEY MACHINERY CO.
537 Union Trust Bldg., Pittsburgh, Pa.

SPECIAL OFFERING

1—2" Acme Upsetter V-Belt Drive, Complete $2,750.00
1—4" National Upsetter, Air Operated Clutch. 12,000 Ser. No. $12,500.00
1—5" National Upsetter, Air Operated Clutch. $13,500.00
1—84" Newton Gear Cutter Complete with C. Gears $1,850.00

FS1238, AMERICAN MACHINIST
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CINCINNATI PRESS BRAKE

130 SERIES 14 FEET

Between housings with bed and ram extended 24" on left side 18'—8" die surface—18" throat two speed attachment 20 H.P. 220 volt 60 cycle 3 phase electricals—brake used only four months and like new.

HARRINGTON-WILSON-BROWN CO.
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MUrray Hill 6-9161

SHEARS FOR SALE

Niagara 10' x 16 Ga. Power Squaring Shear, Serial No. 39586, practically new. Price $2,500.00

Inspection in Our Warehouse

WINSTON MACHINERY CO., INC.
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FOR QUICK REMOVAL

HONING—#249 Barnes, Vert., Hydr. 9" x 16" (1940)
TURRET—3L Gisholt, Hard. Ways
DRILL—3 Spind. Foote-Burt, Power Feed (1942)

PRICE EACH $1500

ROSENKRANZ, WEISBECKER CO.
149 Broadway New York 6, N. Y.

FOR SALE

Kingsbury 8 spindle drilling and tapping machine new condition—price about 1/3 new cost.

SCREW MACHINE MANAGEMENT
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For Sale—G.E. Dynamometer

Blower cooled, dial scale, 20 HP motor 1500/-4500 RPM, 25 HP absorption, complete with motor generator set, 220/440 Volts, controls and accessories. New, never used.

NATHAN MFG. CO.
416 E. 106 ST. NEW YORK 29, N. Y.

FOR SALE

Westinghouse "Endogas" Gas Generator, 200 CFH, 4.5 KW, 55 Volt. Complete with controls, valves, etc. Serial No. 20P788.

PRACTICALLY NEW

WINSTON MACHINERY CO., INC.
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Anything you want

that other readers of this publication can supply

OR—

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that other readers can use advertise it in the
SEARCHLIGHT SECTION OF
American Machinist

LATE TYPE MACHINE TOOLS

AUTOMATICS
6" RPA-8 Acme-Gridley Chucker. 1941.
16" Bullard Mult-Au-Matic, 6 spdl. 41.
1⅝" Greenlee, 6 spindle. 1942.
9/16" RA-6 Acme-Gridley. 1942.
No. 60 New Britain, 1" cap. 1943.

BORING MACHINES
No. 42 Lucas Horizontal. 1940.
No. 54 Excello Double End. 1940.
No. 46B Heald Single End. 1940.

DRILLS
3' 9" Morris "Mor-Speed". Latest.
25" Fosdick "Economax". 1941.
W-6 Baush Hyd. Mult. Spdl. 1943.

GEAR EQUIPMENT
3" & 12" Gleason Generators. 1941.
No. 6 & 17 Gleason Testers. 1943.
12" Red Ring Internal Shaver. Late.
No. GCL-3 Red Ring Shaver. 1942.
No. 624A3 Fellows Side Trimmer. New.
No. 615A & 61A Fellows Shapers. 1943.
No. 7125A & 712 Fellows Shaper. 1943.
Vinco Spline & Gear Grinder. 1942.

GRINDERS, CYLINDRICAL
16" x 36" Cincinnati Plain. 1942.
12" x 48" Cincinnati Univ. 1943.
10" x 72" Landis Plain. 1942.
10" x 18" Norton Plain. 1942.

GRINDERS, INTERNAL
No. 74 Heald Ext. Bridge. 1941.
No. 72A3 & A5 Heald Plain. 1944.
No. 5 & 16A22 Bryant. Latest.

GRINDERS, SURFACE
14" x 36" P&W Vertical. 1938
No. 22 & 25A Heald Rotary. 1943.
No. 2-1 Reid, 6" x 18" cap. 1940.

LATHES, ENGINE
45" x 192" Axelson. 1942.
28" x 276" Bertram. 1942.
24" x 168" Sidney. 1942.
18" x 54" Lodge & Shipley. 1943.
18" x 48" Bradford. 1942.

LATHES, PRODUCTION
Gisholt "Simplimatic". 1940.
No. 3A L&S "Duomatic". 1943.
No. 2FU Foster "Fastermatic". 1943.
20" x 973½" LeBlond Rapid Prod. 1941.
8" x 108" Lo-Swing Semi. Auto. 1942.
Model 8, 10 & 12 Sundstrand. 1942.
14" x 42" Monarch "Magna-Matic". 1941.

LATHES, TURRET
36" Bullard Vertical. 1945.
No. 2A & 3A Warner & Swasey. 1943.
No. 1 & 8½" x 24" Acme Univ. 1943.
No. 2, 3 & 4 Warner & Swasey. 1943.
No. 2, 3, 5 & 7 Bardons & Oliver. 1942.

MILLS, PLAIN
No. 5 Cincinnati. 1942.
No. 4H & 4K Milwaukee. 1943.
No. 3 Van Norman. 1942.
No. 2HL Milwaukee. 1942.

MILLS, PRODUCTION
BL-2420 P&W "Keller", 3 sp. 1942.
BL-2416 P&W "Keller", 1 sp. 1943.
BG-1 Keller, single spdl.
No. 1-14 & 2-20 Kent Owens. 1942.
No. 1248 Kearney & Trecker. 1942.
No. 1-18, 2-18, & 2-24 Cincinnati. 1942.

MILLS, THREAD
6" x 60" Pratt & Whitney. Latest.
12" x 54" Lees Bradner. 1943.
4" x 9" Hanson Whitney. Late.

MILLS, UNIVERSAL
No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No. 2SU & 26SU Van Norman. 1942.

MILLS, VERTICAL
No. 3B P&W Univ. Die Sinker. 1943.
No. 2K & 3H Milwaukee. 1942.
No. 2 & 3 Cincinnati. 1942.
No. 1 Cleveland. 1942.

PRESSES
No. 40 5½ Minster. 1942.
100 Ton Hamilfin, Hyd. 1942.
75 Ton Bliss Hyd., 60" Stroke. Latest.

INDIANAPOLIS MACHINERY & SUPPLY CO.
1961 S. Meridian St.
INDIANAPOLIS 6, IND.

A FEW MACHINES FROM OUR LARGE STOCK

AUTOMATICS
Brown & Sharpe #000, M.S., #4, #6, #2G
Conomatic 8 sp. 1⅞" cap., 66F—2¾" cap.
New Britain Gridley 61—6 Sp. 2¼"

BORING MILLS
Giddings & Lewis #9, #25T, Bullard, 42" V.T.L.
Universal 3" horiz., Lucas #31 horiz.

DRILLS AND RADIALS
Canedy-Otto 3'-9" col.
Carlton 8'-10" col., Foote-Burt 6 Sp.
Cincl-Bickford Super-Service 21", 24"
Natco Model E-5 Multi-Spindle, 14 spindles
Sibley 24—28", Allen 6 Sp., Excelsior 21"

ENGRAVERS
Gorton #3U, 3Z, 3L; Deckel G1.
Gorton Cutter Grinders 375-2, 265-5

GEAR EQUIPMENT
Fellows #72, 725 High Speed, Mikron Gear Hobber
Michigan, Gleason, Fellows Checkers
Gleason #2 Surface Hardener

GRINDERS—Miscellaneous
Brown & Sharpe #5 cyl., 3"x18", Block Diamond
Brown & Sharpe #1, #3 Univ., #13 Univ. & Tool
Cincinnati #2 Centerless Filmatic
Cincinnati Universal Filmatic, 12"x36", 12"x48"
Covel #91A Univ. Tool & Cutter
Gardner #22D, 30° disc. Heald #1 Tool
K. O. Lee Tool & Cutter.
Landis #4H Cyl. 4x12", #8 Thread, Landis Centerless
Norton #2 Tool & Cutter, Porter Cable Belt WG8
Norton Cyl. 6x30" Type C
Oliver #510 Drill Pointer, Sellers #4G
Pratt & Whitney Radius #R6, Gremby Int.

GRINDERS—Surface
Abrasive #1½" Wet, #34 Vertical, #33
Atlantic 6x18" Power Feed, Foote-Burt Hammond
Blanchard #18—42" chuck, #11—10" chuck
Brown & Sharpe #2
G. & L. #23, #35 Hyd.
Hanchett #300, 13x48", Mattison 14x10x48 Hyd.
Norton 6x18" Hyd., Pratt & Whitney 12x30" Vert.
Reid #2A P.F., #2C Pope & Excello Spdl.
Thompson Hyd. 6x10x18", 6x12x18

LATHES
Bradford 16"x6', Hardinge Precision 9", cabinet
Hendey G. H. 16x30 with relieving att.
LeBlond Regal 10"x3½", 15x30", 19x48", 21x60"
Lodge & Shipley 10x78" T.A., LeBlond HD 16x33"
Monarch 10"x20" EE, 16x78" T.A., 12x30" CKK
Monarch Model CKK 14x30" Dble. Compound
Rivett Precision, Logan 10"x30"
South Bend 9"x3", 9"x3½", 13x36", 19" Cabinet
Sebastian 12"x4', G.H., Sheldon 11x24, 1" collet

LATHES—Turret
Acme #6W Bar and Chuck, 6W Fox Lathe
Bardons & Oliver #3, #5, Foster #3B
Brown & Sharpe #1, #2F Hand Screw Mach.
Gisholt #4, 5 Bar & Chuck—2L Saddle type
Hardinge E5M, 2nd operation
Jones & Lamson #6A Univ., Saddle, Threading
Oster #501 Rapiduction, Morey #3, 1½" cap.
Warner & Swasey #3, #4, #5, #4A—6" Bar Cap.

MILLS—Plain & Universal
Brown & Sharpe #2B Pl., #2A Univ.
Cincinnati #3 Plain, 2MH Univ.
Milwaukee #2HL, 2H, Plain, #2WL, 2H, Univ.
Van Norman #12, 20, 22L, 36, Kempsmith 2G

MILLS—Vertical—JIG BORERS
Brown & Sharpe #2, Index, Vernon, Bridgeport
Cincinnati #4, Jackson
Gorton #8D, 9J Plain, #8½D Duplicator
Kearney & Trecker #5H, 3H High Speed
P&W 1½B Jig Borer, Sip Jig Borer #MP-5
Moore Jig Grinder, Vernon Jig borer
Morey #12M Profiler 2 sp.—Pratt & Whitney 12B

MILLS—Production
Brown & Sharpe #000, 12, 21
Cincinnati #1-12, 1-18, 2-18 Mfg.
Nichols Hand, U.S. MM I, Kent Owens #1V
Sundstrand #00 Rigidmills, U. S. Duplex

PRESSES
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Bliss #675, 645B, 650 Hi-Production, 304A, 305A S.S.
Bliss #2B, 21 O.B.I., #4½ Double Action Cam
Bliss #58 OB. Gap Frame #62, 62A, 162
Ferracute Notching #C62
Henry & Wright 25, 75 Ton Dieing
Reliance 45 ton O.B.I.
Thomas 7A, 80 Ton O.B.I., Geo. Flex Elec. Screw
V. & O. #25S O.B.I., #102 Reducing.
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ROUTER: Onsrud #W240, #55 Oliver
SHAPER: 32" G. & E. Universal
TAPPERS: Bakewell #1, Haskins #2C, 3C
THREAD ROLLER: Waterbury-Farrel #30 with Dies
VERTICAL SHAPER: 8" Pratt & Whitney
WELDERS SPOT & SEAM: Solaky, Taylor Winfield, Elsler 50 KVA
WRAPPING ROLL: Buffalo #½

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500 D.A.	H.P.M.	36x36"	24"	80"
1000	French Oil	53x42"	20"	56"
350	Verson	48x40	36"	72"
50	Dennison	22x20	18	23
150	Southwark	34x30	30 2' to 4'	

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800 Ton Birdsboro 40x32 platen—20" stroke
600 Ton Southwark 34x23 platen—20" stroke
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Mill, No. 1-M, 2-M, & 3 Cincinnati, Hort. Overarm, Timken Gearing
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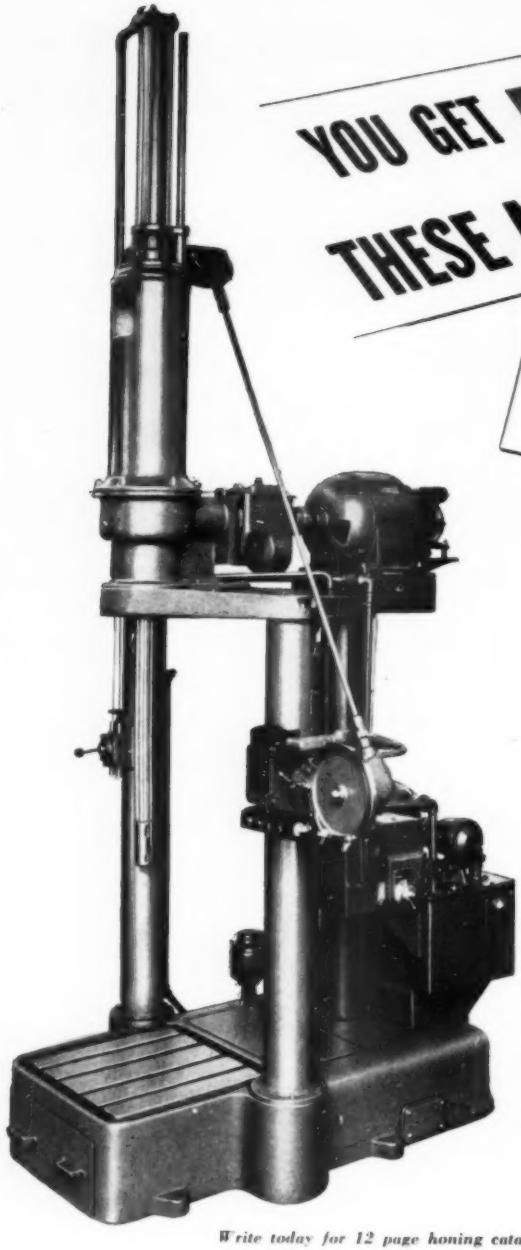

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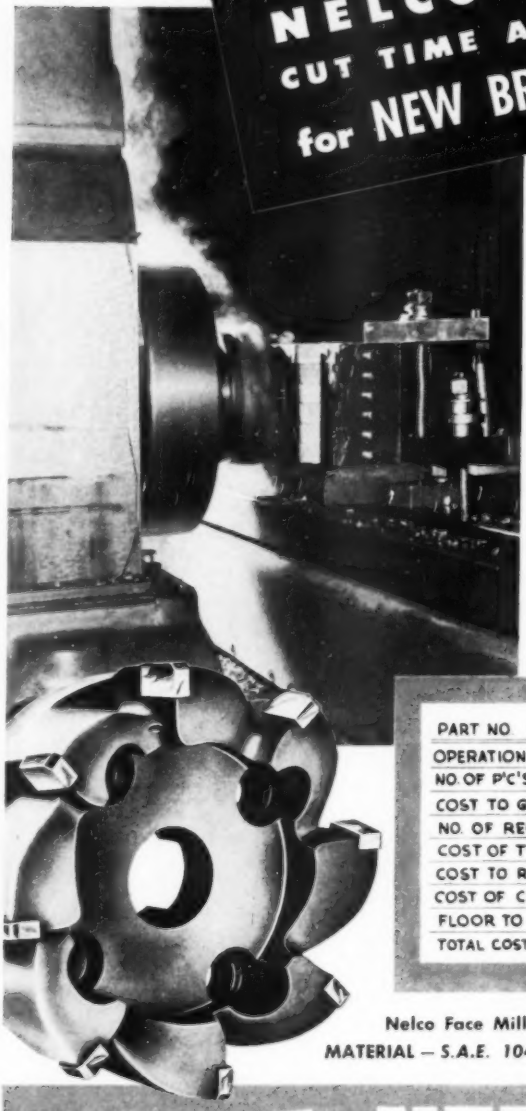
Here's how

NELCO FACE MILLS CUT TIME AND REDUCE COSTS for NEW BRITAIN MACHINE CO.



Milling the Forming Slide Cam blanks for New Britain-Gridley Model 60 six-spindle automatic Bar Machines is done six at a time with the No. 8106F Nelco Face Mill with carbide tipped blades.

The time and cost analysis chart shows the comparative savings effected by Nelco carbide tipped cutters over the tools formerly used. This is only one of many New Britain Parts which are milled efficiently with Nelco Tools.

PART NO. B 407 1782 | NAME Forming Slide Cam blank

OPERATION 110 mill end	CARBIDE	HIGH SPEED
NO. OF P'C'S PER GRIND	400	100
COST TO GRIND	$7.50	$3.75
NO. OF REGRINDS	8	10
COST OF TIPS	$8.00	$16.20
COST TO RETIP & GRIND	$16.00	$6.00
COST OF CUTTER PER PIECE	$ .024	$.054
FLOOR TO FLOOR TIME	1½ min	3½ min
TOTAL COST TO MILL ONE P'C.	$ .144	$.324

Nelco Face Mill No. 8106F . . . **SPECIFICATIONS**

MATERIAL — S.A.E. 1045 GAS CUT SPEED — 500 R.P.M. FEED — 15" P.M.

WRITE for descriptive literature and name of your Nelco Distributor.

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For that extra edge in production

NELCO TOOL CO., INC., Manchester, Conn.

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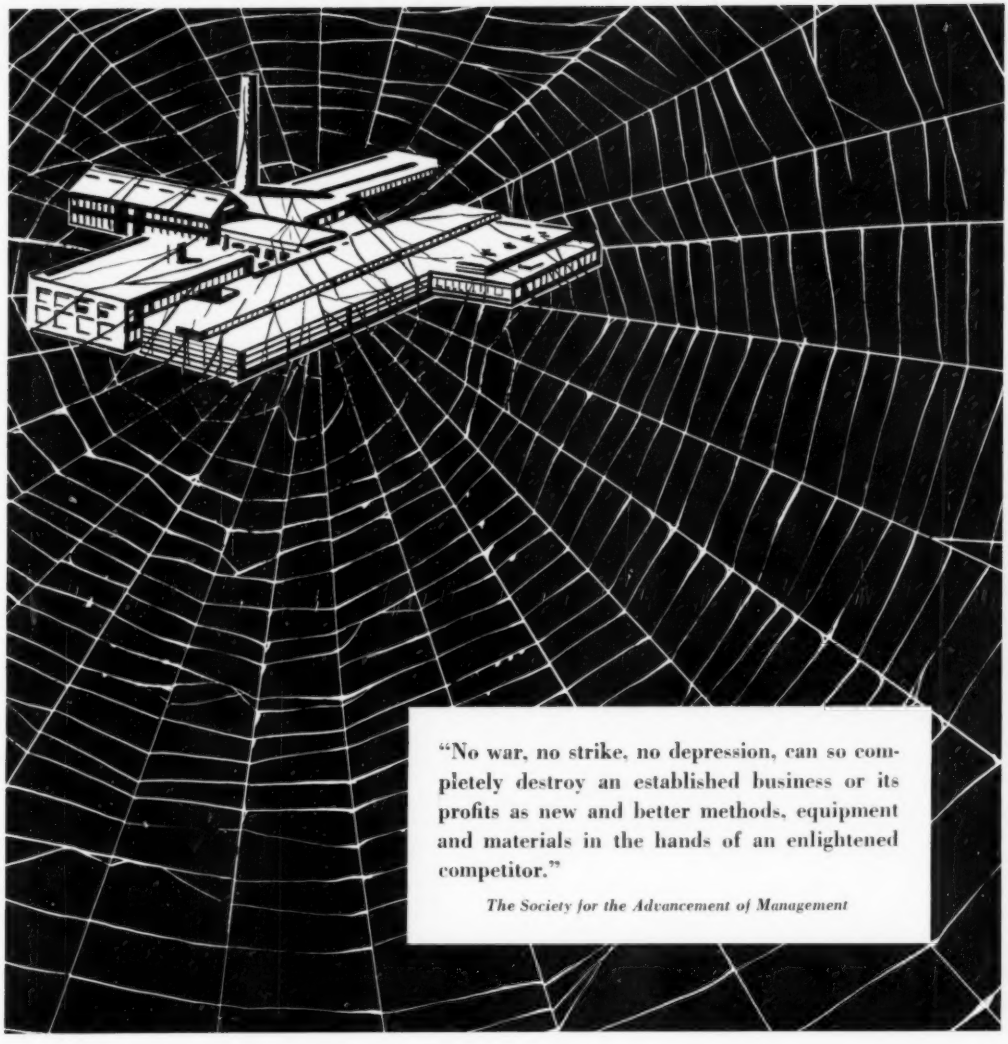

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